# U.S. Army Center for Health Promotion and Preventive Medicine

USCHPPM

## PYROTECHNICS HEALTH RISK ASSESSMENT NO. 39-EJ-1485-99 RESIDENTIAL EXPOSURE FROM INHALATION OF AIR EMISSIONS FROM THE M126A1 RED STAR PARACHUTE SIGNAL FLARE

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## *U.S. Army Center for Health Promotion and Preventive Medicine*

*The lineage of the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) can be traced back over 50 years. This organization began as the U.S. Army Industrial Hygiene Laboratory, established during the industrial buildup for World War II, under the direct supervision of the Army Surgeon General. Its original location was at the Johns Hopkins School of Hygiene and Public Health. Its mission was to conduct occupational health surveys and investigations within the Department of Defense's (DOD's) industrial production base. It was staffed with three personnel and had a limited annual operating budget of three thousand dollars.*

*Most recently, it became internationally known as the U.S. Army Environmental Hygiene Agency (AEHA). Its mission expanded to support worldwide preventive medicine programs of the Army, DOD, and other Federal agencies as directed by the Army Medical Command or the Office of The Surgeon General, through consultations, support services, investigations, on-site visits, and training.*

*On 1 August 1994, AEHA was redesignated the U.S. Army Center for Health Promotion and Preventive Medicine with a provisional status and a commanding general officer. On 1 October 1995, the nonprovisional status was approved with a mission of providing preventive medicine and health promotion leadership, direction, and services for America's Army.*

*The organization's quest has always been one of excellence and the provision of quality service. Today, its goal is to be an established world-class center of excellence for achieving and maintaining a fit, healthy, and ready force. To achieve that end, the CHPPM holds firmly to its values which are steeped in rich military heritage:*

★ *Integrity is the foundation*
★ *Excellence is the standard*
★ *Customer satisfaction is the focus*
★ *Its people are the most valued resource*
★ *Continuous quality improvement is the pathway*

*This organization stands on the threshold of even greater challenges and responsibilities. It has been reorganized and reengineered to support the Army of the future. The CHPPM now has three direct support activities located in Fort Meade, Maryland; Fort McPherson, Georgia; and Fitzsimons Army Medical Center, Aurora, Colorado; to provide responsive regional health promotion and preventive medicine support across the U.S. There are also two CHPPM overseas commands in Landstuhl, Germany and Camp Zama, Japan who contribute to the success of CHPPM's increasing global mission. As CHPPM moves into the 21st Century, new programs relating to fitness, health promotion, wellness, and disease surveillance are being added. As always, CHPPM stands firm in its commitment to Army readiness. It is an organization proud of its fine history, yet equally excited about its challenging future.*

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This assessment evaluated the potential for human health effects to offsite residents breathing air emissions following use of the M126A1 Red Star Parachute Signal Flare during training exercises. The military uses pyrotechnics for signaling, obscuring, and illumination during training exercises to simulate battle conditions. Study results showed no potential for health risks to the hypothetical resident from inhalation of air emissions from the M126A1. To conduct this study, air emissions from the M126A1 were collected in a test chamber ( at Dugway Proving Grounds, UT. This information was then used in an air dispersion model to determine ambient air concentrations at a location 100 meters (downwind from the site where the item was activated. Modeled air concentrations were combined with exposure information to estimate the amount of substances the hypothetical resident breathes. This intake was combined with the substance's health information, to determine if there is a potential for health risks from inhjalation of these substances. The health risk included both long-term and short term exposures to the modeled substance concentrations. Study results showed no potential for helath risks from inhalation of air emissions from the M126A1.

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# PYROTECHNICS HEALTH RISK ASSESSMENT NO. 39-EJ-1485-99 RESIDENTIAL EXPOSURE FROM INHALATION OF AIR EMISSIONS FROM THE M126A1 RED STAR PARACHUTE SIGNAL FLARE

## EXECUTIVE SUMMARY

This assessment evaluated the potential for human health effects to offsite residents breathing air emissions following use of the M126A1 Red star parachute signal flare (M126A1) during training exercises. The military uses pyrotechnics for signaling, obscuring, and illuminating during training and combat. Pyrotechnics are also used during training exercises to simulate battle conditions. Study results showed that no adverse health impacts are expected, to the hypothetical resident, from inhalation of the air emissions from the M126A1.

To conduct this study, air emissions from the M126A1 were collected in a test chamber (Bang Box) at the Dugway Proving Ground, Utah. This information was then used in an air dispersion model to determine ambient air concentrations at a location 100 meters (328 feet) downwind from the site where the M126A1 was activated. Since the training facility in this study is hypothetical, the air model used assumptions that provided conservative estimates of air concentrations.

Modeled air concentrations were combined with exposure information (e.g., number of exposures per year) to estimate the amount of substances the hypothetical resident breathes. This intake was combined with the substance's health information, which was obtained from agencies such as the U.S. Environmental Protection Agency, to determine if there is a potential for health risks from inhalation of these substances.

The health risk study included both long-term (30 years) and short-term (15-minute or 1-hour) exposures to modeled substance concentrations. Study results showed no potential for health risks to the hypothetical resident from inhalation of air emissions from the M126A1.

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| | |
|---|---|
| AEC | U.S. Army Environmental Center |
| AEGL | Acute Exposure Guideline Levels |
| AIHA | American Industrial Hygiene Association |
| ATV | Acute Toxicity Value |
| DODIC | Department of Defense Identification Code |
| DOD | Department of Defense |
| DOE | U.S. Department of Energy |
| EPA | U.S. Environmental Protection Agency |
| ERPG | Emergency Response Planning Guidelines |
| HBSL | Health-Based Screening Level |
| NAAQS | National Ambient Air Quality Standards |
| NAC/AEGL | National Advisory Committee for Acute Exposure Guideline Levels |
| NEW | Net Explosive Weight |
| OEL | Occupational Exposure Limit |
| $PM_{10}$ | Particulate Matter under 10 micrometers in size |
| PRG | Preliminary Remediation Goals |
| RBC | Risk-Based Concentration |
| RfC | Reference Concentration |
| TEEL | Temporary Emergency Exposure Limits |
| TPCWG | Total Petroleum Criteria Working Group |
| TSP | Total Suspended Particulates |
| USACHPPM | U.S. Army Center for Health Promotion and Preventive Medicine |

# PYROTECHNICS HEALTH RISK ASSESSMENT
# NO. 39-EJ-1485-99
# RESIDENTIAL EXPOSURE FROM INHALATION OF AIR EMISSIONS FROM THE M126A1 RED STAR PARACHUTE SIGNAL FLARE

## 1. PURPOSE

This document presents the evaluation of the potential for human health effects to offsite residents breathing air emissions following use of the M126A1 Red star parachute signal flare (M126A1) during training exercises.

## 2. AUTHORITY

Memorandum, U.S. Army Environmental Center, 4 June 1999, Subject: Pyrotechnics Risk Assessment.

## 3. REFERENCES

See Appendix A.

## 4. BACKGROUND

### a. PYROTECHNICS AND THEIR USE

The term pyrotechnic is derived from the Greek words "pyr" and "techne" meaning fire and art. The terms pyrotechnics and fireworks are often used interchangeably. Examples of pyrotechnics include distress flares and fireworks used for commercial (for public displays) and consumer (e.g., sparklers) use. Every year during New Year and Independence Day celebrations fireworks are used for public displays across the country. During the 1998 Olympic Winter games in Nagano, Japan, almost 5000 pyrotechnics were launched during a firework display that lasted 8 minutes.

The military uses pyrotechnics for four purposes: 1) as a method of communication through the use of signals, 2) to produce smoke to reduce enemy effectiveness, 3) for illuminating the field, and 4) to simulate battle conditions during training exercises. Pyrotechnics play an important role in both military training and combat. It is important that our troops are adequately trained to use them properly.

### b. WHAT IS THE M126A1 RED STAR PARACHUTE SIGNAL FLARE?

The M126A1 is a star parachute signal flare, which is a type of pyrotechnic device used for signaling and illuminating. The M126A1 produces a single,

red, parachute-suspended illuminating star. It is 10.16 inches long, 1.67 inches wide, and weighs 1.20 pounds (Reference 1).

c. USE OF THE M126A1 RED STAR PARACHUTE SIGNAL FLARE

The M126A1 is used during many Army training events. These events are held at nearly every Army training installation. In general, one item is used during a day of training, which typically occurs five times per year. A rocket containing the signal is launched from a hand-held device. After igniting, the rocket reaches a height of about 200 feet and produces a single, red star illumination resembling a firework. The signal extends to a height of 700 to 750 feet and can be seen from a distance of 30 to 35 miles at night (References 2, 3). Use of this device is important in training our troops to use and identify different signals, which is an important method of communication in the field.

d. ASSESSMENT SUMMARY

The approach for this study consisted of two main parts: air dispersion modeling and exposure assessment. These are briefly discussed in the paragraphs below. Sections 5-7 present a more explicit discussion of the methodology used for this study.

Data generated in the "Bang Box" at the Dugway Proving Ground, Utah (Reference 4), were used with an atmospheric dispersion model (Reference 5) to estimate the average concentrations that would be experienced by an offsite resident. Since this study is designed to provide results that would be applicable to most Army training facilities, the training area used in this evaluation was a hypothetical one. In addition, air-modeling parameters were selected to mimic worst-case conditions.

The exposure assessment included calculations of time-averaged concentrations for both long-term (chronic) and short-term (acute) exposures. For the purpose of this study, air concentrations were averaged over 30 years for chronic exposures and 1 hour or 15 minutes for acute exposures. These concentrations were compared to chronic health-based screening levels (HBSLs) established by the U.S. Environmental Protection Agency (EPA) or acute toxicity values (ATVs) established by selected agencies depending on the exposure duration (i.e., 30 years versus 1 hour or 15 minutes). If the chronic and acute averaged concentrations ($C_{chronic}$ and $C_{acute}$) were greater than these screening levels, further analysis would be warranted to determine the potential for health effects. It should be noted that concentrations greater than the screening levels do not indicate an onset of health effects, but rather the potential for such.

## 5. METHODS AND DATA COLLECTION

### a. EMISSION FACTORS

The air modeling emission rates were derived from the pyrotechnics emission studies conducted at Dugway Proving Ground, Utah (Reference 4). These studies sampled air emissions from the firing of weapons and/or munitions used in training. The purpose of this sampling was to identify and quantify the air emissions. The data provided by Dugway Proving Ground included the identification of the munitions item and compounds sampled, net explosive weight (NEW) of the item, vertical and horizontal dimensions of the plume from thermograph data and video, and compound emission factors. This data is included in the tables in Appendix B.

### b. AIR MODEL

#### (1) BACKGROUND

Air dispersion models are available to mathematically simulate atmospheric conditions and behavior to predict downwind concentrations caused by emissions from various sources. However, specific models are not available to estimate the dispersion of emissions from the use of munitions in training. The emissions from munitions used in training result in ambient concentrations of compounds at various locations. The magnitude and location of these concentrations depend on many factors including the amount and type of emissions, the behavior of the source, and meteorological conditions. Based on the evaluation of air dispersion models for military munitions, the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) recommended using the Integrated PUFF (INPUFF) model to estimate the dispersion of emissions from mobile pyrotechnics (Reference 6).

#### (2) MODEL DESCRIPTION

The INPUFF Model was developed to simulate dispersion from instantaneous or semi-continuous point sources. This Gaussian-integrated puff model is capable of addressing a puff type release over short periods of time, and computations can be performed for a single point source for multiple receptors. The algorithm used to calculate concentrations uses a vertically uniformed wind direction (with no chemical reaction) to compute the contribution of each puff at a receptor for each time step/interval.

#### (3) ASSUMPTIONS

Some assumptions were made to best represent the M126A1 in the air model. These assumptions were as follows:

(a) For unconventional sources with no physical stack dimensions, the initial horizontal and vertical dispersion values ($\sigma_y$ and $\sigma_z$) of the released puff were used to define the dimensions of the puff. Therefore, plume rise and formation were not determined by characterizing flue gas exit velocity and stack diameter, as they are with conventional point sources. The initial dimensions were set to values measured during Dugway Proving Ground testing and the dispersion of the initial cloud was modeled. The physical dimensions, including height and length of the puff or cloud, were estimated from the thermograph data recorded at every time step. The data also included minimum, mean, and maximum temperature readings during the duration of the emission test and were used to define the flue gas exit temperature. These puffs were then modeled at different release heights as depicted in Figure 1.

(b) The worst-case release scenario analysis was performed using EPA Risk Management Program Guidance (Reference 7). This guidance includes tables for estimating the footprint of chemical releases. These guidelines were intended to inform emergency responders of the worst possible accidental release, but not necessarily the most likely. The EPA has defined most default conditions for meteorological modeling parameters. Table 1 lists the parameters that were used in the model.

(c) The resident used in this study was assumed to be directly downwind from the source. The meander of the puff is a major factor when estimating concentrations at given locations downwind from the source. Assuming that the resident is directly downwind from the source is the same as assuming that there is no puff meander and provides the most conservative modeled concentrations.

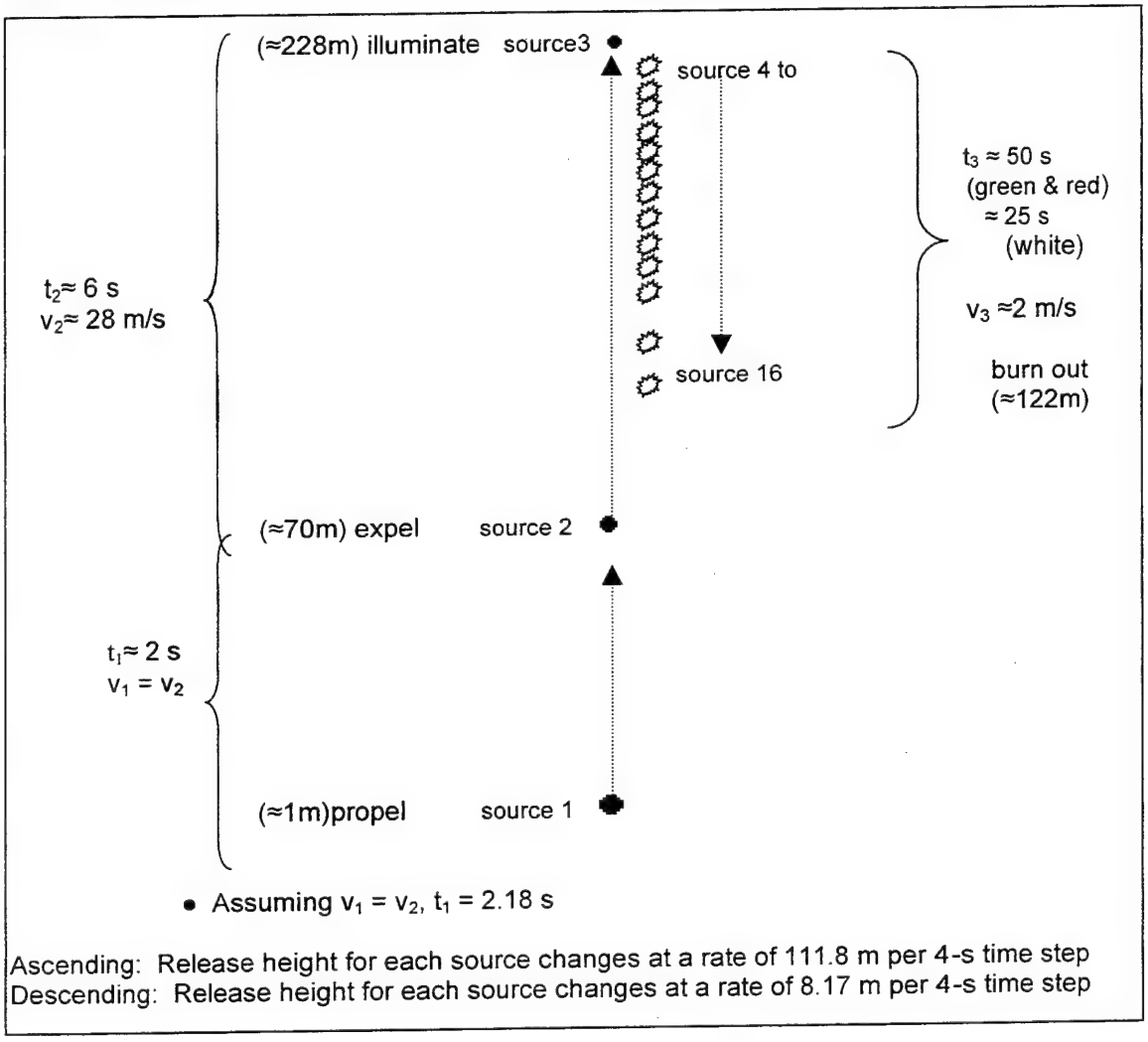
(d) For the purpose of this study, the number of items per event was defined as the activation of one item during a 24-hour period.

(e) Figure 1 provides a schematic diagram of the trajectory of the M126A1. The data for Figure 1 were obtained from References 1 and 8. The performance data provided estimated travel times (t), and velocities (v) at which the items ascend and descend.

**TABLE 1. AIR MODEL INPUT PARAMETERS**

| **MODEL PARAMETERS** | |
|---|---|
| Number of meteorological periods (NTIME) | 1 |
| Duration of each meteorological period (ITIME) | 400 s |
| Number of updates to the source (NSRCDS) | 100 per source |
| Duration between each source update/time-step (ISUPDT) | 4 s |
| Total time modeled/Simulation Period (NTIME * ITIME) | 400 s |
| **SOURCE PARAMETERS** | |
| Source/Stack Diameter | 0.5 m for sources (1-16). |
| Source/Stack Height | See Table 3. |
| Source Exit Temperature | Varied for each source every time step (4 s) degrees Kelvin (K) |
| Exit Velocity | NA |
| Emission Rate | 1 g/s |
| Initial horizontal dispersion ($\sigma_y$) | Varied for each source every time step (4 s) |
| Initial vertical dispersion ($\sigma_z$) | Varied for each source every time step (4 s) |
| **WORST CASE METEOROLOGICAL PARAMETERS** | |
| Wind Speed | 1 m/s |
| Atmospheric Stability | Category F |
| Wind Direction | 270° degrees West |
| Ambient Temperature | 293 degrees Kelvin (K) or 68 °F |
| Worst case Receptor Location | 100 m directly downwind |

## FIGURE 1: SCHEMATIC DIAGRAM OF THE TRAJECTORY OF THE M126A1



## (4) GENERAL METHODOLOGY

(a) The INPUFF model determined the amount of time it would take for the puff to pass over a location 100 meters (m) downwind. The released puff migrated at the constant wind speed of one meter per second (1 m/s) downwind from the point of activation. Assuming a distance of 100 m and a travel velocity of 1 m/s, it took 100 s for the center of each puff to reach this distance. The source was modeled at the appropriate release heights and intermediate concentrations were calculated by INPUFF at a receptor located at 100 meters.

(b) The model was run with a total runtime of 400 s to ensure that the total mass of the puff had passed the receptor and the source behavior recorded in the thermograph data was sufficiently simulated. Since the model is capable of providing 100 updates (puffs), each intermediate puff was assumed to be 400 s divided by 100 updates, which is 4 s. Calculated concentrations every time step (4 s) indicated that the puff reached the receptor within 80 s and dissipated below a unit concentration of $1 \times 10^{-10}$ grams/$m^3$ within 136 s.

(c) The parachute flares were modeled as 16 different sources with different source parameters for each time step. A different release height with varying release temperatures was used for each source. Table 2 illustrates how the emissions for the M126A1 were separated into 16 different point sources and the emissions for each source were staggered over a burn time of 64 s.

**TABLE 2: M126A1 SOURCE SIMULATION**

| Source No. | Height (m) | Unit Emission Rate of 1g/s per time step * |
|---|---|---|
| 1 | 1.0 | 0 to 4 s |
| 2 | 112.0 | 4 to 8 s |
| 3 | 228.0 | 8 to 12 s |
| 4 | 220.0 | 12 to 16 s |
| 5 | 212.0 | 16 to 20 s |
| 6 | 203.0 | 20 to 24 s |
| 7 | 196.0 | 24 to 28 s |
| 8 | 187.0 | 28 to 32 s |
| 9 | 179.0 | 32 to 36 s |
| 10 | 171.0 | 36 to 40 s |
| 11 | 163.0 | 40 to 44 s |
| 12 | 154.0 | 44 to 48 s |
| 13 | 146.0 | 48 to 52 s |
| 14 | 138.0 | 52 to 56 s |
| 15 | 130.0 | 56 to 60 s |
| 16 | 122.0 | 60 to 64 s |

* The emission rates return to 0 g/s for all time steps not shown in the table. Note: the location of each of the sources with z representing the base elevation was modeled at (x,y,z)=(0,0,0)

## (5) USE OF MODEL OUTPUT

The concentrations provided by the INPUFF model are based on a unit emission rate of 1 g/s from an emission source and does not represent any pollutant-specific concentration from the use of pyrotechnics. The relationship between the emission rate and predicted concentration is linear. Therefore, the ratio of the predicted concentration to the unit emission rate was multiplied by each pollutant-specific emission rate to provide pollutant-specific concentrations.

## (6) DETERMINATION OF POLLUTANT-SPECIFIC EMISSION RATES

(a) The actual emission rate per item ($ER_1$) for each pollutant was calculated using the following equation:

$$ER_1 = \frac{M \cdot CV}{t} \qquad \text{Equation 1}$$

where:

$ER_1$ = emission rate for one item (g/(item*sec))
$M$ = total mass (lb) of pollutant emitted per item (lb/item)
$CV$ = conversion factor (453.59 g/lb)
$t$ = release duration in seconds (s) (References 1, 8)

**Example 1**
**Sample Calculation Using Equation 1*:**

$$ER_1 = \frac{(1.306\text{E-}01)(453.59)}{(64)}$$

= 9.254E-01 g/(s*item)

*Calculation for TSP. Averaged adjusted emission factor of total suspended particulates (TSP) in lb/item was obtained from Appendix B.

(b) The pollutant emission rate for an event ($ER_{EV}$) for each pollutant was calculated using the estimated number of potential items used in a training event according to the following equation:

$$ER_{EV} = ER_1 \cdot I \qquad \text{Equation 2}$$

where:

$ER_{EV}$ = emission rate for the estimated number of potential items used in a training event (g/s)
$ER_1$ = emission rate for one item (g/(item*sec))
$I$ = items per event (item/event)

**Example 2**
**Sample Calculation Using Equation 2*:**

$$ER_{EV} = (9.254E-01)(1)$$

= 9.254E-01 g/s

* Calculation for TSP

(c) Pollutant-specific ambient concentrations for an event (CONC) were calculated using the following equation:

$$CONC = ER_{EV} \cdot \frac{UC}{ER_{unit}} \qquad \text{Equation 3}$$

where:

CONC = pollutant concentration based on the number of items used in a training event ($g/m^3$)
$ER_{EV}$ = emission rate for the estimated number of items used in a training event (g/s)
$ER_{unit}$ = unit emission rate as used in the model (g/sec)
$UC$ = concentration based on the unit emission rate ($g/m^3$)

**Example 3**
**Sample Calculation Using Equation 3*:**

$$CONC = (9.254E-01)\frac{(3.028E-04)}{(1)}$$

= 2.802E-04 $g/m^3$

* Calculation for TSP

## c. EXPOSURE ASSESSMENT

### (1) EXPOSURE ASSUMPTIONS

(a) Exposure assumptions were selected using a typical use scenario for the M126A1. This use scenario was developed based on consultation with the U.S. Army Environmental Center's (AEC) senior training advisor (References 9, 10). The frequency of use of the M126A1 was required to determine how much substance an offsite resident would be exposed to in the time period of interest (i.e., acute or chronic exposure). For the purposes of this study, a training scenario is defined as a day or session of training whereas a training event is defined as a single use of pyrotechnics. A training scenario may consist of multiple training events. Table 3 summarizes the specific assumptions used to determine how often the M126A1 is used during a training scenario.

**TABLE 3: FREQUENCY OF USE FOR THE M126A1**

| Parameter | Value Used |
|---|---|
| Number of items used per training scenario | 1 |
| Number of items used per training event | 1 |
| Number of training events per scenario | 1 |
| Time between events | NA |
| Number of scenarios per year | 5 |

(b) To estimate the air emissions, it was assumed that one M126A1 was activated. The puff that resulted from this event was modeled to a point 100 meters downwind. Since the unit emission rate was calculated using a runtime of 400 seconds, each event was also assumed to last 400 seconds (or 6.67 minutes).

### (2) TIME-AVERAGING

For the chronic assessment, time-averaged concentrations were calculated using the EPA's default residential exposure duration of 30 years (this value assumes that the resident spends 30 years at the same residence). This was done to derive concentrations that would be consistent with the exposure duration used by the EPA so that estimated substance concentrations could be compared to their respective HBSLs.

In this evaluation, training scenarios occur five times a year (References 9, 10). Using the default residence time established by the EPA, the assumption was made that someone could be exposed to five training scenarios per year for 30 years.

(a) The daily averaged concentrations were calculated using Equation 4. An example calculation using cadmium is included in Example 4. It should be noted that the average modeled concentration was converted from g/m$^3$ to µg/m$^3$ before it was used in Equation 4.

$$C_d = \frac{CONC \cdot ET \cdot EF_{day}}{1440} \qquad \text{Equation 4}$$

where:

$C_d$ = average daily concentration (µg/m$^3$)
$CONC$ = average modeled concentration (µg/m$^3$)
$ET$ = exposure time (minutes/event)
$EF_{day}$ = exposure frequency (events/day)
$1440$ = unit conversion from minutes to day

**Example 4**
**Sample Calculation Using Equation 4:**

$$C_{d(cadmium)} = \frac{(1.418E-03)(6.667)(1)}{1440}$$

= 6.565E-06 µg/m$^3$

The averaged modeled concentration (CONC) for cadmium was obtained from Appendix B. The exposure parameters were obtained from Table 4.

(b) Chronic averaged concentrations were calculated using Equation 5. The resulting concentration ($C_d$) from Equation 4 was used in Equation 5 to determine the averaged chronic concentrations. Example 5 shows how this calculation was performed.

$$C_{chronic} = \frac{C_d \cdot EF_{year} \cdot ED}{AT} \qquad \text{Equation 5}$$

where:

$C_{chronic}$ = average chronic concentration (µg/m$^3$)
$C_d$ = average daily concentration (µg/m$^3$)
$EF_{year}$ = exposure frequency (days/year)
$ED$ = exposure duration (years)
$AT$ = averaging time (days)
(for carcinogenic endpoint, AT = 70 years x 365 days; noncarcinogenic endpoint, AT = ED x 365 days)

**Example 5**
**Sample Calculation Using Equation 5:**

$$C_{chronic\,(cadmium)} = \frac{(6.565E-06)(5)(30)}{(70)(365)}$$

$$= 3.854E\text{-}08\ \mu g/m^3$$

The average daily concentration was calculated as shown in Example 4. The exposure parameters were obtained from Table 4. The averaging time for cadmium is based on the carcinogenic endpoint.

(c) This study assumed that the same person would be exposed 5 days every year for 30 years. Table 4 lists the exposure parameters used in Equations 4 and 5.

**TABLE 4: EXPOSURE PARAMETERS USED TO DETERMINE TIME-AVERAGED CHRONIC AIR CONCENTRATIONS**

| Exposure Parameter | Value Used |
|---|---|
| Exposure Time (ET) | 6.67 minutes/event |
| Exposure Frequency ($EF_{day}$) | 1 event/day |
| Exposure Frequency ($EF_{year}$) | 5 days/year |
| Exposure Duration (ED) | 30 years |

(d) Unlike the chronic evaluation, guidance for evaluating acute exposures is not currently available. Due to the nature of the use of pyrotechnics and short duration of the concentration plume, acute exposures cannot be overlooked. For the purpose of this study, acute exposure is defined as a 1-hour or 15 minute exposure. The 1-hour or 15 minute acute exposure averaging times allow for comparison with guidelines developed specifically for emergency planning purposes (see discussion on acute toxicity below). This is a conservative assumption since the air model indicated that the hypothetical resident is not expected to be exposed for more than 7 minutes to the concentration plume following activation of the M126A1.

(e) The average acute concentrations were computed using Equation 6. The exposure frequency is based on the number of events per 1-hour or 15 minutes depending on the guideline used for comparison. Example 6 contains a sample calculation of this equation.

$$C_{acute} = \frac{CONC \cdot ET \cdot EF_{hour}}{60}$$ Equation 6

where:

$C_{acute}$ = average acute concentration (µg/m$^3$)
CONC = average modeled concentration (µg/m$^3$)
ET = exposure time (minutes/event)
$EF_{hour}$ = exposure frequency (events/hour)
60 = unit conversion, 60 minutes/hour

**Example 6**
**Sample Calculation Using Equation 6:**

$$C_{acute(cadmium)} = \frac{(1.418E-03)(6.667)(1/0.25)}{60}$$

= 6.302E-04 µg/m$^3$

The average modeled concentration (CONC) for cadmium was obtained from Appendix B. Since the acute toxicity value for cadmium is based on a 15-minute exposure duration (TEEL), the acute concentration was averaged over 15 minutes so that $C_{acute}$ can be compared with its toxicity value.

d. TOXICITY ASSESSMENT

The potential for health risks was determined by comparing time-averaged air concentrations to health-based screening levels, which are developed from a substance's known toxicity. These toxicity values typically include different levels of safety factors depending on the level of confidence of the critical study. Appendix C contains a table of screening values used for the chronic and acute evaluations.

(1) CHRONIC ASSESSMENT

(a) The chronic assessment was evaluated using a screening approach. Using this method, a substance's estimated time-averaged air concentration was compared to its HBSL. If this ratio was less than one, no further analysis was required. This approach is conservative because the exposure assumptions used by the EPA, to establish HBSLs, assume that the resident is exposed for 350 days per year (assuming 2 weeks vacation per year). Since the training scenarios, in which the M126A1 is used, are not expected to exceed 5 days per year, HBSLs specific to this study (if they were developed) would likely be higher.

(b) HBSLs were obtained from the EPA, primarily from Region 3 and Region 9 (References 11, 12). To ensure that the most recent information was used, the Internet sites of both regions were checked. Although the general

approach used by both Region 3 and Region 9 is the same, the exposure assumptions differ enough so that final recommended screening levels can vary to a certain degree. In both methods a substance's HBSL is selected using the toxicity endpoint that derives a lower concentration. For example, if a substance has a known systemic toxicity and is a carcinogen, concentrations were calculated using both toxicity information. The lower concentration was then selected as the recommended screening level to maintain a conservative approach.

(c) A hierarchy was developed in order to quantitatively evaluate for as many of the identified substances as possible. Since the methodology used by Region 9 results in lower HBSLs than Region 3, the Region 9 preliminary remediation goals (PRGs) were used first. Region 3's risk-based concentrations (RBCs) were only used when a PRG was not available. The only exception was for chromium (VI) [Cr (VI)] where Region 9 used a carcinogenic toxicity value that was seven times greater than the EPA's recommended value to develop its screening level for inhalation exposure (Reference 13). Since the EPA does not advocate the application of this multiplication factor, the RBC for Cr (VI) was used instead of the PRG.

(d) Some substances have neither PRGs nor RBCs because they have their own set of regulatory standards. Under the Clean Air Act, the EPA is required to establish National Ambient Air Quality Standards (NAAQS) (Reference 14) for several substances considered harmful to public health and the environment. Currently, NAAQS are available for six substances, of which carbon monoxide, nitrogen dioxide, lead, sulfur dioxide, and particulate matter < 10 micrometers ($PM_{10}$) have been detected in the M126A1 Bang Box study. The NAAQS for the longer averaging time were used for the chronic evaluation. Depending on the substance, this can range from an 8-hour average to an annual average. In addition, since the majority of the measured total suspended particulates (TSP) were $PM_{10}$ (Reference 4), the NAAQS for $PM_{10}$ was used to evaluate the potential for health effects from exposure to TSP.

**Example 7**
**Sample Calculation Comparing a Substance's Estimated Chronic Concentration to Its Health-Based Screening Level:**

$$\frac{C_{chronic(cadmium)}}{HBSL} = \frac{3.85E-08}{1.07E-03}$$

= 3.60E-05 <1

The HBSL used for cadmium is a PRG. In this case, the resulting ratio is five orders of magnitude less than one, indicating further evaluation is not necessary.

(e) Many petroleum hydrocarbons were detected but do not have specific screening levels. Therefore, the approach recommended by the Total Petroleum Criteria Working Group (TPHCWG) (Reference 15) was adopted to evaluate petroleum hydrocarbon mixtures. Based on the working group's assessment of various hydrocarbons, they recommended that mixtures be separated according to a substance's number of carbons and its chemical class (i.e., aliphatic or aromatic[1]). Generally, as a substance's carbon number increases, its molecular weight increases and it is therefore, not a substance of concern via inhalation. The working group also concluded that aromatic hydrocarbons tend to be more toxic than aliphatic hydrocarbons (Reference 15).

(f) Table 5 tabulates the inhalation toxicity values used to evaluate exposure to petroleum mixtures. To be consistent with the methodology used in this study, the reference concentrations (RfCs) were converted to PRGs using Region 9 assumptions. The resulting PRGs are included in Table D-4 in Appendix D.

**TABLE 5: SUMMARY OF RfCs USED FOR PETROLEUM HYDROCARBONS (Reference 15)**

| Carbon Range | Aromatic Inhalation RfC ($mg/m^3$) | Aliphatic Inhalation RfC ($mg/m^3$) |
|---|---|---|
| $C_5 - C_6$<br>$C_{>6} - C_8$ | | 18.4 |
| $C_{>7} - C_8$ | 0.4 | |
| $C_{>8} - C_{10}$<br>$C_{>10} - C_{12}$<br>$C_{>12} - C_{16}$ | 0.2 | 1.0 |
| $C_{>16} - C_{21}$<br>$C_{>21} - C_{35}$ | NA | NA |

NA = not applicable for high molecular weight TPHs ($C_{>16}$) because compounds in this carbon range are not volatile and therefore, inhalation is not a pathway of concern.

(2) ACUTE ASSESSMENT

(a) As previously indicated, an acceptable method for assessing acute health effects is not currently available. It was not until recently that EPA guidance addressed the need to evaluate acute health effects from inhalation (Reference 16). Even then, acute toxicity data for risk assessment purposes were not readily available. The EPA recognized this deficiency

[1] Aliphatic hydrocarbons are hydrocarbons in which the carbon atoms are joined by single covalent bonds consisting of two shared electrons (e.g., butane). Aromatic hydrocarbons have ring structures (e.g., benzene) (Reference 21).

and spearheaded the National Advisory Committee for Acute Exposure Guideline Levels for Hazardous Substances (NAC/AEGL Committee). However, AEGLs are currently available for only a handful of substances.

(b) To circumvent this problem, several state regulatory agencies have suggested that guidelines developed for emergency purposes be used in the interim. Although suggestions have been made to use occupational exposure limits (OELs) by applying additional safety factors (References 17, 18), OELs were not used in this study because they introduce even more uncertainty than the use of emergency guidelines. OELs are designed to protect the workplace environment and assume 8 hours a day, 5 days a week exposures. By definition, these exposures are more chronic than acute.

(c) In comparison, emergency planning guidelines are more appropriate because they are typically developed exposures of 1-hour or less. In addition, safety factors may also have been included depending on the agency that develops these guidelines, so that the values would be protective of the general population.

(d) Emergency Response Planning Guidelines (ERPGs) published by the American Industrial Hygiene Association (AIHA) (Reference 19) and the Temporary Emergency Exposure Limits (TEELs) developed by the U.S. Department of Energy (DOE) (Reference 20) were used for this study; specifically the ERPG-1s and the TEEL-1s. Since TEEL-1s are intended for 15-minute exposures, air concentrations compared to TEELs were averaged over a 15-minute period as opposed to 1-hour in this assessment. The AIHA defines ERPG-1 as follows:

"The maximum concentration in air below which it is believed nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor."

The DOE defines TEEL-1 as follows:

"The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor."

(e) For this study, ERPGs were selected prior to a substance's TEEL because they are vigorously reviewed before they are published whereas the TEELs are not. Example 8 shows a sample calculation of how a substance's estimated acute concentration is compared to its acute toxicity value.

**Example 8**
**Sample Calculation of Comparing a Substance's Estimated Acute Concentration to Its Acute Toxicity Value:**

$$\frac{C_{acute\,(cadmium)}}{ATV} = \frac{6.30E-04}{3.00E+01}$$

= 2.10E-05 <1

The acute toxicity value available for cadmium is a TEEL. In this example with cadmium, the ratio is five orders of magnitude below 1, indicating that further analysis is not necessary.

## 6. RISK CHARACTERIZATION

Appendix D presents results from the M126A1 risk characterization. Note that for some substances, two concentrations were reported because of different analytical test methods (as noted in bold). In those instances, the higher concentration was used.

### a. CHRONIC HEALTH RISK

The outcome indicated that no chronic health impacts are expected from breathing the air emissions from the M126A1. Since all ratios were below one, no further evaluation was needed.

### b. ACUTE HEALTH RISK

For the acute analysis, all ratios were below one, indicating that no acute health impacts are expected from breathing the air emissions from the M126A1. Since all ratios for the acute evaluation were below one, no further assessment was needed.

### c. SUBSTANCES WITH NO TOXICITY DATA

Some substances were not quantitatively evaluated because they do not have established toxicity data. By conducting a semi-qualitative comparison of the concentrations of these substances to similar compounds with available toxicity data, it may be concluded that no potential for health effects would be expected from exposure to these substances.

d. FACT SHEET

A copy of the fact sheet submitted to AEC is included as Appendix E. The fact sheet uses the results from this study to summarize health concerns related to inhalation of M126A1 air emissions.

7. UNCERTAINTY DISCUSSION

The limitations inherent in modeling and the added conservatism of the evaluation contribute to the uncertainty of the study results. The risk assessment methodology typically includes safety factors that are embedded in the toxicity data to ensure adequate protection of the general population, particularly, susceptible individuals such as the sick, elderly, and children. Table 6 identifies areas of uncertainty associated with this assessment.

**TABLE 6: TYPES OF UNCERTAINTY**

| Issue | Uncertainty | Direction of Effect |
|---|---|---|
| **Modeling** | | |
| Modeled versus real-time sampling | The air concentrations in this study were modeled. Actual air concentrations taken from the field may be higher or lower. | Varies |
| Frequency of use for the M126A1 | Actual frequency of use of M126A1s during a training event may be different from those stated in this report. | Varies |
| Hypothetical resident assumed to be located directly downwind | Unless the area around the training facility is populated, the chances that a person living directly downwind is low. | Overestimates |
| Use of worst-case meteorological conditions | To ensure that this study is applicable to most training areas, worst-case meteorological conditions were used in the air model. | Overestimates |
| **Exposure Assessment** | | |
| Estimating time-averaged concentrations | Actual exposure from the M126A1 is intermittent. If one were to plot a person's exposure profile, the plot would consist of a series of spikes. Since current risk assessment methodology does not allow the evaluation of the potential for health risks as a function of time, a single concentration, averaged over the exposure duration was used. In this study, the exposure durations used were 30 years and 1-hour or 15 minutes. | Varies |

## TABLE 6: TYPES OF UNCERTAINTY

| Issue | Uncertainty | Direction of Effect |
|---|---|---|
| Chromium speciation | All chromium was assumed to be present as Cr(VI), which is more toxic than Cr(III). | Overestimates |
| Comparing estimated concentration to established screening levels | The Region 3 and Region 9 HBSLs were developed using different exposure assumptions than those in this study, resulting in more conservative screening levels. | Overestimates |
| Screening assessment versus calculating an average daily intake | Calculating an average daily intake allows the use of scenario-specific assumptions. However, unless the ratio of concentration to screening level approaches one, a screening assessment is useful as a first-cut evaluation. | Varies |
| Exposure to other munitions | Other munitions are typically used during the same training event. These items may contain similar or different substances from those detected in the M126A1. | Underestimates |
| **Toxicity Assessment** | | |
| Lack of toxicity data | Some substances were not quantitatively evaluated because they have no known toxicity data. | Underestimates |
| Modifying and uncertainty factors for toxicity data | Modifying factors and uncertainty factors of varying degree are typically applied to toxicological values. These factors are used to conservatively account for extrapolating from animal studies for human health evaluation, and to conservatively account for variation in human populations. | Overestimates |

## 8. CONCLUSION

Results indicated that residents who live as close as 100 meters directly downwind from training areas are safe from breathing air emissions from the M126A1. It is believed that the assumptions contained in this analysis are conservative enough to be protective of all the population including the sick, elderly, and children.

## 9. RECOMMENDATIONS

Since the results from this study are intended for a hypothetical training facility, they can vary depending on site-specific conditions. However, because of the conservative assumptions used (e.g., worst-case meteorological conditions, receptor located directly downwind, etc.) it is believed that most site-specific analyses would result in even lower concentrations. Therefore, the results from this evaluation should be applicable to most training facilities unless site-specific conditions vary significantly.

## 10. POINT OF CONTACT

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# APPENDIX A

# REFERENCES

1. U.S. Army (1994). *Technical Manual, Army Ammunition Data Sheets: Military Pyrotechnics* (Federal Supply Class 1370). TM-43-0001-37.

2. U.S. Army (date unknown). *Chapter 5: Ground Pyrotechnic Signals.* http://155.217.58.58/cgi-bin/atdl.dll/fm/23-30/Ch5.htm.

3. U.S. Army (1991). *Operator's Manual, Pyrotechnic Signals.* TM 9-1370-206-10.

4. U.S. Army (1999). *Sampling Results for AEC Phase I Training Ordnance Emission Characterization*, Volume I-Summary Report. Prepared by Radian International LLC, Oak Ridge, TN, for U.S. Army Dugway Proving Ground, Dugway, UT.

5. Bowman Environmental, Inc. (1999). *INPUFF2, Multiple Source Integrated Puff Model*, Version 4.1.

6. USACHPPM (April 2000). *Draft Ambient Air Quality Consultation NO. 43-EL-1485-00 Air Dispersion Modeling Evaluation For Military Munitions*, Aberdeen Proving Ground, MD.

7. Title 40, Code of Federal Regulations, Part 68 (40 CFR 68), Chemical Accident Prevention Provisions, 1 July 1998.

8. U.S. Army Training and Doctrine Command Digital Library, http://www.adtdl.army.mil/

9. U.S. Army (1999). Personal communication between Mr. Tony Pitrat, USACHPPM, and Ms. Tamera Clark-Rush, AEC. July 1999.

10. Army Training Evaluation Protocol (ARTEP) 7-20-MTP, *Mission Training Plan for the Infantry Battalion.*

11. EPA (April 1999). *Region 3 Risk Based Concentration (RBC) Tables.* Available online at www.epa.gov/reghwmd/risk/riskmenu.htm

12. EPA (Oct. 1999). *Region 9 Preliminary Remediation Goals (PRG).* Available online at www.epa.gov/region09/waste/sfund/prg/index.html

13. EPA (1999). *Integrated Risk Information System.* Available online at http://www.epa.gov/iris/

14. EPA. *National Ambient Air Quality Standards.* Available online at http://www.epa.gov/ airprogm/airs/criteria.html

15. Total Petroleum Hydrocarbon Criteria Working Group (1997). *Development of Fraction Specific Reference Doses (RfDs) and Reference Concentrations (RfCs) for Total Petroleum Hydrocarbons (TPH)*, Volume 4. Amherst Scientific Publishers. Amherst, MA.

16. EPA (1998). *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities*, Volumes I-III. EPA530-D-98-001A-C.

17. U.S. Army (1996). *Final Screening Risk Assessment for the Anniston Chemical Agent Disposal Facility at the Anniston Army Depot, Alabama*. Revision No. 5. Prepared by the U.S. Army Center for Health Promotion and Preventive Medicine for the Program Manager for Chemical Demilitarization. Aberdeen Proving Ground, Maryland.

18. U.S. Army (1997). *Final Screening Risk Assessment for the Pine Bluff Chemical Agent Disposal Facility at the Pine Bluff Arsenal, Arkansas*. Revision No. 1. Prepared by the U.S. Army Center for Health Promotion and Preventive Medicine for the Program Manager for Chemical Demilitarization. Aberdeen Proving Ground, Maryland.

19. American Industrial Hygiene Association (AIHA). *Emergency Response Planning Guidelines*. AIHA Press, Fairfax, VA.

20. Department of Energy (1998). *Temporary Emergency Exposure Limits*, Revision 15. http://www.scapa.bnl.gov.

21. Manahan, Stanley (1994). *Environmental Chemistry*. Sixth edition. CRC Press, Inc. Boca Raton, FL.

# APPENDIX B

# AIR DISPERSION MODELING OUTPUT DATA

## Table B-1: Air Modeling Output Data for Metals, Particulates, and Miscellaneous Compounds

| | Red Parachute Signal Flare | | | | Items per event (I): | 1 | item/event | |
|---|---|---|---|---|---|---|---|---|
| | NEW, lb = 0.29 | | | | release duration (t): | 64 | seconds | |
| | Number of Items = 1 | | | | Unit Concentration (UC): | 3.028E-04 | $g/m^3/(g/s)$ | |
| Compound | Measured Actual Concentration ($mg/m^3$) | Measured Background Concentration ($mg/m^3$) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted (grams/item) M | Pollutant Concentration 1 Item ($grams/m^3$) CONC | Pollutant Emission Rate (g/sec)/item $ER_1$ | Event Pollutant Emission Rate 1 Item (g/sec) $ER_{EV}$ |
| **Particulate** | | | | | | | | |
| TSP | 5.739E+01 | 8.516E-02 | 4.503E-01 | 1.306E-01 | 5.923E+01 | 2.802E-04 | 9.254E-01 | 9.254E-01 |
| $PM_{10}$ | 5.735E+01 | ND | 4.259E-01 | 1.235E-01 | 5.602E+01 | 2.650E-04 | 8.753E-01 | 8.753E-01 |
| | | | | | | | | |
| **$HCl/Cl_2$** | | | | | | | | |
| HCl | 2.232E-02 | 3.676E-02 | ND | ND | ND | ND | ND | ND |
| $Cl_2$ | 6.850E-02 | 3.646E-02 | 2.626E-04 | 7.615E-05 | 3.454E-02 | 1.634E-07 | 5.397E-04 | 5.397E-04 |
| | | | | | | | | |
| **Dioxin/Furan** | | | | | | | | |
| Dioxin TEQ | 3.056E-10 | 7.123E-11 | 1.921E-12 | 5.570E-13 | 2.527E-10 | 1.195E-15 | 3.948E-12 | 3.948E-12 |
| | | | | | | | | |
| **CEM System** | | | | | | | | |
| Carbon Monoxide (CO) | 4.230E+00 | NM (b) | 3.594E-02 | 1.042E-02 | 4.727E+00 | 2.237E-05 | 7.386E-02 | 7.386E-02 |
| Nitrogen Oxide (NOx) | 1.272E+00 | 1.678E-02 | 1.056E-02 | 3.063E-03 | 1.389E+00 | 6.573E-06 | 2.171E-02 | 2.171E-02 |
| HCl | 3.152E-01 | 2.725E-01 | 3.590E-04 | 1.041E-04 | 4.722E-02 | 2.234E-07 | 7.379E-04 | 7.379E-04 |
| Carbon Dioxide ($CO_2$) | 7.010E+02 | 6.426E+02 | 4.915E-01 | 1.425E-01 | 6.465E+01 | 3.059E-04 | 1.010E+00 | 1.010E+00 |
| Sulfur Dioxide ($SO_2$) | 3.279E-02 | 3.162E-03 | 2.493E-04 | 7.231E-05 | 3.280E-02 | 1.552E-07 | 5.125E-04 | 5.125E-04 |
| | | | | | | | | |
| **Particulate-phase Metals** | | | | | | | | |
| Aluminum | 7.480E-02 | NM (a) | 5.877E-04 | 1.704E-04 | 7.731E-02 | 3.658E-07 | 1.208E-03 | 1.208E-03 |
| Antimony | 1.958E-04 | NM (a) | 1.539E-06 | 4.462E-07 | 2.024E-04 | 9.575E-10 | 3.162E-06 | 3.162E-06 |
| Arsenic | ND | NM (a) | ND | ND | ND | ND | ND | ND |
| Barium | 1.585E-01 | NM (a) | 1.245E-03 | 3.611E-04 | 1.638E-01 | 7.749E-07 | 2.559E-03 | 2.559E-03 |
| Beryllium | ND | NM (a) | ND | ND | ND | ND | ND | ND |
| Cadmium | 2.899E-04 | NM (a) | 2.278E-06 | 6.606E-07 | 2.997E-04 | 1.418E-09 | 4.682E-06 | 4.682E-06 |
| Chromium | 1.505E-03 | NM (a) | 1.182E-05 | 3.429E-06 | 1.555E-03 | 7.359E-09 | 2.430E-05 | 2.430E-05 |
| Cobalt | 1.967E-04 | NM (a) | 1.545E-06 | 4.481E-07 | 2.033E-04 | 9.616E-10 | 3.176E-06 | 3.176E-06 |
| Copper | 3.031E-03 | NM (a) | 2.382E-05 | 6.906E-06 | 3.133E-03 | 1.482E-08 | 4.895E-05 | 4.895E-05 |
| Lead | 1.108E-03 | NM (a) | 8.704E-06 | 2.524E-06 | 1.145E-03 | 5.417E-09 | 1.789E-05 | 1.789E-05 |
| Magnesium | 6.836E+00 | NM (a) | 5.372E-02 | 1.558E-02 | 7.066E+00 | 3.343E-05 | 1.104E-01 | 1.104E-01 |
| Manganese | 1.042E-02 | NM (a) | 8.187E-05 | 2.374E-05 | 1.077E-02 | 5.095E-08 | 1.683E-04 | 1.683E-04 |

## Table B-1: Air Modeling Output Data for Metals, Particulates, and Miscellaneous Compounds

| | Red Parachute Signal Flare | | | | Items per event (I): | 1 | item/event | |
|---|---|---|---|---|---|---|---|---|
| | NEW, lb = 0.29 | | | | release duration (t): | 64 | seconds | |
| | Number of Items = 1 | | | | Unit Concentration (UC): | 3.028E-04 | $g/m^3/(g/s)$ | |
| Compound | Measured Actual Concentration ($mg/m^3$) | Measured Background Concentration ($mg/m^3$) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted (grams/item) | Pollutant Concentration 1 Item ($grams/m^3$) | Pollutant Emission Rate (g/sec)/item | Event Pollutant Emission Rate 1 Item (g/sec) |
| Nickel | 3.014E-04 | NM (a) | 2.368E-06 | 6.868E-07 | 3.115E-04 | 1.474E-09 | 4.868E-06 | 4.868E-06 |
| Phosphorus | 5.149E-03 | NM (a) | 4.046E-05 | 1.173E-05 | 5.322E-03 | 2.518E-08 | 8.315E-05 | 8.315E-05 |
| Selenium | ND | NM (a) | ND | ND | ND | ND | ND | ND |
| Silver | ND | NM (a) | ND | ND | ND | ND | ND | ND |
| Thallium | ND | NM (a) | ND | ND | ND | ND | ND | ND |
| Zinc | 2.879E-03 | NM (a) | 2.262E-05 | 6.560E-06 | 2.975E-03 | 1.408E-08 | 4.649E-05 | 4.649E-05 |
| Mercury | 4.105E-05 | NM (a) | 3.226E-07 | 9.354E-08 | 4.243E-05 | 2.007E-10 | 6.630E-07 | 6.630E-07 |

Footnotes:
ND = Not Detected
NEW = Net Explosive Weight
NM = Not Measureable
a = Insufficient material to analyze.
b = Concentration reported was less than zero.

## Table B-2: Air Modeling Output Data for Volatile Organic Compounds

| | Red Parachute Signal Flare | | | | Items per event (I): | 1 | item/event | |
|---|---|---|---|---|---|---|---|---|
| | NEW, lb = 0.29 | | | | release duration (t): | 64 | seconds | |
| | Number of Items = 1 | | | | Unit Concentration (UC): | 3.028E-04 | $g/m^3/(g/s)$ | |
| Compound | Measured Actual Concentration ($mg/m^3$) | Measured Background Concentration ($mg/m^3$) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted (grams/item) M | Pollutant Concentration 1 Item ($grams/m^3$) CONC | Pollutant Emission Rate (g/sec)/item $ER_1$ | Event Pollutant Emission Rate 1 Item (g/sec) $ER_{EV}$ |
| **Total Nonmethane Hydrocarbons (TNMHC)** | | | | | | | | |
| TNMHC | 2.051E-01 | 5.460E-02 | 1.153E-03 | 3.343E-04 | 1.517E-01 | 7.175E-07 | 2.370E-03 | 2.370E-03 |
| | | | | | | | | |
| **Volatile Organic Compounds (VOCs)** | | | | | | | | |
| Ethane | 7.150E-03 | 1.600E-03 | 4.253E-05 | 1.233E-05 | 5.595E-03 | 2.647E-08 | 8.741E-05 | 8.741E-05 |
| Ethylene | 5.835E-02 | 2.000E-04 | 4.456E-04 | 1.292E-04 | 5.862E-02 | 2.773E-07 | 9.159E-04 | 9.159E-04 |
| Acetylene | 4.110E-02 | 6.000E-04 | 3.104E-04 | 9.000E-05 | 4.083E-02 | 1.932E-07 | 6.379E-04 | 6.379E-04 |
| Propane | 1.950E-03 | 7.000E-04 | 9.579E-06 | 2.778E-06 | 1.260E-03 | 5.962E-09 | 1.969E-05 | 1.969E-05 |
| Propene | 1.305E-02 | 3.000E-04 | 9.771E-05 | 2.833E-05 | 1.285E-02 | 6.081E-08 | 2.008E-04 | 2.008E-04 |
| i-Butane | 7.500E-04 | 5.000E-04 | 1.916E-06 | 5.556E-07 | 2.520E-04 | 1.192E-09 | 3.938E-06 | 3.938E-06 |
| i-Butene | 7.000E-04 | ND | 5.364E-06 | 1.556E-06 | 7.056E-04 | 3.338E-09 | 1.103E-05 | 1.103E-05 |
| 1-Butene | 2.500E-03 | ND | 1.916E-05 | 5.556E-06 | 2.520E-03 | 1.192E-08 | 3.938E-05 | 3.938E-05 |
| 1,3-Butadiene | 3.200E-03 | ND | 2.452E-05 | 7.111E-06 | 3.226E-03 | 1.526E-08 | 5.040E-05 | 5.040E-05 |
| n-Butane | 2.150E-03 | 1.800E-03 | 2.682E-06 | 7.778E-07 | 3.528E-04 | 1.669E-09 | 5.513E-06 | 5.513E-06 |
| trans-2-Butene | 2.500E-03 | ND | 1.916E-05 | 5.556E-06 | 2.520E-03 | 1.192E-08 | 3.938E-05 | 3.938E-05 |
| 2,2-Dimethylpropane | ND | ND | ND | ND | ND | ND | ND | ND |
| cis-2-Butene | 4.500E-04 | ND | 3.448E-06 | 1.000E-06 | 4.536E-04 | 2.146E-09 | 7.088E-06 | 7.088E-06 |
| 3-Methyl-1-butene | ND | ND | ND | ND | ND | ND | ND | ND |
| i-Pentane | 3.100E-03 | 3.100E-03 | ND | ND | ND | ND | ND | ND |
| 1-Pentene | 5.000E-04 | ND | 3.832E-06 | 1.111E-06 | 5.040E-04 | 2.385E-09 | 7.875E-06 | 7.875E-06 |
| 2-Methyl-1-butene | 1.000E-04 | ND | 7.663E-07 | 2.222E-07 | 1.008E-04 | 4.769E-10 | 1.575E-06 | 1.575E-06 |
| n-Pentane | 2.700E-03 | 2.100E-03 | 4.598E-06 | 1.333E-06 | 6.048E-04 | 2.862E-09 | 9.450E-06 | 9.450E-06 |
| Isoprene | 5.000E-04 | ND | 3.832E-06 | 1.111E-06 | 5.040E-04 | 2.385E-09 | 7.875E-06 | 7.875E-06 |
| trans-2-Pentene | 1.000E-04 | ND | 7.663E-07 | 2.222E-07 | 1.008E-04 | 4.769E-10 | 1.575E-06 | 1.575E-06 |
| cis-2-Pentene | 1.000E-04 | ND | 7.663E-07 | 2.222E-07 | 1.008E-04 | 4.769E-10 | 1.575E-06 | 1.575E-06 |
| 2-Methyl-2-butene | 2.000E-04 | ND | 1.533E-06 | 4.445E-07 | 2.016E-04 | 9.538E-10 | 3.150E-06 | 3.150E-06 |
| 2,2-Dimethylbutane | 6.000E-04 | 4.000E-04 | 1.533E-06 | 4.445E-07 | 2.016E-04 | 9.538E-10 | 3.150E-06 | 3.150E-06 |
| Cyclopentene | 1.500E-04 | ND | 1.149E-06 | 3.333E-07 | 1.512E-04 | 7.154E-10 | 2.363E-06 | 2.363E-06 |
| 4-Methyl-1-pentene | ND | ND | ND | ND | ND | ND | ND | ND |
| Cyclopentane | 1.500E-04 | 1.000E-04 | 3.832E-07 | 1.111E-07 | 5.040E-05 | 2.385E-10 | 7.875E-07 | 7.875E-07 |
| 2,3-Dimethylbutane | 2.500E-04 | 2.000E-04 | 3.832E-07 | 1.111E-07 | 5.040E-05 | 2.385E-10 | 7.875E-07 | 7.875E-07 |
| cis-4-Methyl-2-pentene | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Methylpentane | 1.200E-03 | 1.100E-03 | 7.663E-07 | 2.222E-07 | 1.008E-04 | 4.769E-10 | 1.575E-06 | 1.575E-06 |

## Table B-2: Air Modeling Output Data for Volatile Organic Compounds

| Compound | Measured Actual Concentration ($mg/m^3$) | Measured Background Concentration ($mg/m^3$) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted (grams/item) M | Pollutant Concentration 1 Item ($grams/m^3$) CONC | Pollutant Emission Rate (g/sec)/item $ER_1$ | Event Pollutant Emission Rate 1 Item (g/sec) $ER_{EV}$ |
|---|---|---|---|---|---|---|---|---|
| 3-Methylpentane | 5.000E-04 | 6.000E-04 | ND | ND | ND | ND | ND | ND |
| 2-Methyl-1-pentene | ND | ND | ND | ND | ND | ND | ND | ND |
| 1-Hexene | 4.000E-04 | ND | 3.065E-06 | 8.889E-07 | 4.032E-04 | 1.908E-09 | 6.300E-06 | 6.300E-06 |
| n-Hexane | 1.100E-03 | 1.000E-03 | 7.663E-07 | 2.222E-07 | 1.008E-04 | 4.769E-10 | 1.575E-06 | 1.575E-06 |
| trans-2-Hexene | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Methyl-2-pentene | ND | ND | ND | ND | ND | ND | ND | ND |
| cis-2-Hexene | ND | ND | ND | ND | ND | ND | ND | ND |
| Methylcyclopentane | 5.500E-04 | 4.000E-04 | 1.149E-06 | 3.333E-07 | 1.512E-04 | 7.154E-10 | 2.363E-06 | 2.363E-06 |
| 2,4-Dimethylpentane | 1.000E-04 | 1.000E-04 | ND | ND | ND | ND | ND | ND |
| Benzene | 6.900E-03 | 1.100E-03 | 4.445E-05 | 1.289E-05 | 5.847E-03 | 2.766E-08 | 9.135E-05 | 9.135E-05 |
| Cyclohexane | 4.000E-04 | ND | 3.065E-06 | 8.889E-07 | 4.032E-04 | 1.908E-09 | 6.300E-06 | 6.300E-06 |
| 2-Methylhexane | 4.000E-04 | 4.000E-04 | ND | ND | ND | ND | ND | ND |
| 2,3-Dimethylpentane | 4.000E-04 | 5.000E-04 | ND | ND | ND | ND | ND | ND |
| 3-Methylhexane | 4.500E-04 | 6.000E-04 | ND | ND | ND | ND | ND | ND |
| 2,2,4-Trimethylpentane | 1.250E-03 | 1.300E-03 | ND | ND | ND | ND | ND | ND |
| n-Heptane | 6.500E-04 | 4.000E-04 | 1.916E-06 | 5.556E-07 | 2.520E-04 | 1.192E-09 | 3.938E-06 | 3.938E-06 |
| 2,4,4-Trimethyl-1-pentene | ND | ND | ND | ND | ND | ND | ND | ND |
| Methylcyclohexane | 3.500E-04 | 4.000E-04 | ND | ND | ND | ND | ND | ND |
| 2,4,4-Trimethyl-2-pentene | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,5-Dimethylhexane | 1.500E-04 | 1.000E-04 | 3.832E-07 | 1.111E-07 | 5.040E-05 | 2.385E-10 | 7.875E-07 | 7.875E-07 |
| 2,4-Dimethylhexane | 1.000E-04 | 2.000E-04 | ND | ND | ND | ND | ND | ND |
| 2,3,4-Trimethylpentane | 3.000E-04 | 3.000E-04 | 4.154E-22 | 1.205E-22 | 5.465E-20 | 2.585E-25 | 8.538E-22 | 8.538E-22 |
| Toluene | 3.700E-03 | 2.500E-03 | 9.196E-06 | 2.667E-06 | 1.210E-03 | 5.723E-09 | 1.890E-05 | 1.890E-05 |
| 2,3-Dimethylhexane | 1.000E-04 | 2.000E-04 | ND | ND | ND | ND | ND | ND |
| 2-Methylheptane | 2.000E-04 | 1.000E-04 | 7.663E-07 | 2.222E-07 | 1.008E-04 | 4.769E-10 | 1.575E-06 | 1.575E-06 |
| 3-Ethylhexane | 2.000E-04 | 1.000E-04 | 7.663E-07 | 2.222E-07 | 1.008E-04 | 4.769E-10 | 1.575E-06 | 1.575E-06 |
| 2,2-Dimethylheptane | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,2,4-Trimethylhexane | ND | 1.000E-04 | ND | ND | ND | ND | ND | ND |
| n-Octane | 2.000E-04 | 1.000E-04 | 7.663E-07 | 2.222E-07 | 1.008E-04 | 4.769E-10 | 1.575E-06 | 1.575E-06 |
| Ethylcyclohexane | ND | ND | ND | ND | ND | ND | ND | ND |
| Ethylbenzene | 1.100E-03 | 1.300E-03 | ND | ND | ND | ND | ND | ND |
| m-Xylene & p-Xylene | 4.350E-03 | 5.400E-03 | ND | ND | ND | ND | ND | ND |
| Styrene | 4.500E-04 | ND | 3.448E-06 | 1.000E-06 | 4.536E-04 | 2.146E-09 | 7.088E-06 | 7.088E-06 |
| o-Xylene | 1.500E-03 | 2.000E-03 | ND | ND | ND | ND | ND | ND |
| n-Nonane | 7.500E-04 | ND | 5.747E-06 | 1.667E-06 | 7.560E-04 | 3.577E-09 | 1.181E-05 | 1.181E-05 |
| i-Propylbenzene | ND | ND | ND | ND | ND | ND | ND | ND |

## Table B-2: Air Modeling Output Data for Volatile Organic Compounds

| Compound | Measured Actual Concentration ($mg/m^3$) | Measured Background Concentration ($mg/m^3$) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted (grams/item) M | Pollutant Concentration 1 Item ($grams/m^3$) CONC | Pollutant Emission Rate (g/sec)/item $ER_1$ | Event Pollutant Emission Rate 1 Item (g/sec) $ER_{EV}$ |
|---|---|---|---|---|---|---|---|---|
| n-Propylbenzene | 2.000E-04 | ND | 1.533E-06 | 4.445E-07 | 2.016E-04 | 9.538E-10 | 3.150E-06 | 3.150E-06 |
| p-Ethyltoluene | 5.000E-04 | ND | 3.832E-06 | 1.111E-06 | 5.040E-04 | 2.385E-09 | 7.875E-06 | 7.875E-06 |
| m-Ethyltoluene | 3.000E-04 | ND | 2.299E-06 | 6.667E-07 | 3.024E-04 | 1.431E-09 | 4.725E-06 | 4.725E-06 |
| 1,3,5-Trimethylbenzene | 2.500E-04 | ND | 1.916E-06 | 5.556E-07 | 2.520E-04 | 1.192E-09 | 3.938E-06 | 3.938E-06 |
| o-Ethyltoluene | 4.000E-04 | ND | 3.065E-06 | 8.889E-07 | 4.032E-04 | 1.908E-09 | 6.300E-06 | 6.300E-06 |
| 1,2,4-Trimethylbenzene & sec-Butylbenzene | 6.000E-04 | ND | 4.598E-06 | 1.333E-06 | 6.048E-04 | 2.862E-09 | 9.450E-06 | 9.450E-06 |
| n-Decane | ND | 2.000E-04 | ND | ND | ND | ND | ND | ND |
| alpha-Pinene | ND | ND | ND | ND | ND | ND | ND | ND |
| beta-Pinene | ND | ND | ND | ND | ND | ND | ND | ND |
| delta 3-Carene | ND | ND | ND | ND | ND | ND | ND | ND |
| d-Limonene | ND | ND | ND | ND | ND | ND | ND | ND |
| MTBE | ND | 4.000E-04 | ND | ND | ND | ND | ND | ND |
| Dichlorodifluoromethane | 1.653E-03 | 1.680E-03 | ND | ND | ND | ND | ND | ND |
| Methylchloride | ND | ND | ND | ND | ND | ND | ND | ND |
| Dichlorotetrafluoroethane | ND | ND | ND | ND | ND | ND | ND | ND |
| Chloroethene | ND | ND | ND | ND | ND | ND | ND | ND |
| **1,3-Butadiene** | 3.255E-03 | ND | 2.494E-05 | 7.233E-06 | 3.281E-03 | 1.552E-08 | 5.126E-05 | 5.126E-05 |
| Methylbromide | ND | ND | ND | ND | ND | ND | ND | ND |
| Ethylchloride | 1.398E-04 | ND | 1.072E-06 | 3.108E-07 | 1.410E-04 | 6.669E-10 | 2.203E-06 | 2.203E-06 |
| Trichloromonofluoromethane | 2.650E-03 | 2.785E-03 | ND | ND | ND | ND | ND | ND |
| Vinylidenechloride | ND | ND | ND | ND | ND | ND | ND | ND |
| Methylenechloride | ND | ND | ND | ND | ND | ND | ND | ND |
| Allylchloride | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | 9.017E-04 | 9.470E-04 | ND | ND | ND | ND | ND | ND |
| 1,1-Dichloroethane | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2-Dichloroethene | ND | ND | ND | ND | ND | ND | ND | ND |
| Chloroform | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2-Dichloroethane | ND | ND | ND | ND | ND | ND | ND | ND |
| Methylchloroform | 3.200E-04 | 3.474E-04 | ND | ND | ND | ND | ND | ND |
| **Benzene** | 7.018E-03 | 1.119E-03 | 4.521E-05 | 1.311E-05 | 5.947E-03 | 2.814E-08 | 9.292E-05 | 9.292E-05 |
| Carbontetrachloride | 7.155E-04 | 8.244E-04 | ND | ND | ND | ND | ND | ND |
| 1,2-Dichloropropane | ND | ND | ND | ND | ND | ND | ND | ND |
| Trichloroethylene | ND | ND | ND | ND | ND | ND | ND | ND |
| cis 1,3-Dichloro-1-propene | ND | ND | ND | ND | ND | ND | ND | ND |
| trans 1,3-Dichloro-1-propene | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,1,2-Trichloroethane | ND | ND | ND | ND | ND | ND | ND | ND |

## Table B-2: Air Modeling Output Data for Volatile Organic Compounds

| Compound | Measured Actual Concentration ($mg/m^3$) | Measured Background Concentration ($mg/m^3$) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted (grams/item) M | Pollutant Concentration 1 Item ($grams/m^3$) CONC | Pollutant Emission Rate (g/sec)/item $ER_1$ | Event Pollutant Emission Rate 1 Item (g/sec) $ER_{EV}$ |
|---|---|---|---|---|---|---|---|---|
| **Toluene** | 3.763E-03 | 2.543E-03 | 9.353E-06 | 2.712E-06 | 1.230E-03 | 5.821E-09 | 1.922E-05 | 1.922E-05 |
| 1,2-Dibromoethane | ND | ND | ND | ND | ND | ND | ND | ND |
| Perchloroethylene | ND | ND | ND | ND | ND | ND | ND | ND |
| Chlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| **Ethylbenzene** | 1.689E-03 | 1.996E-03 | ND | ND | ND | ND | ND | ND |
| **m&p-Xylene** | 4.424E-03 | 5.492E-03 | ND | ND | ND | ND | ND | ND |
| **Styrene** | 4.577E-04 | ND | 3.507E-06 | 1.017E-06 | 4.614E-04 | 2.183E-09 | 7.209E-06 | 7.209E-06 |
| 1,1,2,2-Tetrachloroethane | ND | ND | ND | ND | ND | ND | ND | ND |
| **o-Xylene** | 1.526E-03 | 2.034E-03 | ND | ND | ND | ND | ND | ND |
| **p-Ethyltoluene** | 5.086E-04 | ND | 3.897E-06 | 1.130E-06 | 5.126E-04 | 2.425E-09 | 8.010E-06 | 8.010E-06 |
| **1,3,5-Trimethylbenzene** | 3.051E-04 | ND | 2.338E-06 | 6.781E-07 | 3.076E-04 | 1.455E-09 | 4.806E-06 | 4.806E-06 |
| **1,2,4-Trimethylbenzene** | 6.103E-04 | ND | 4.677E-06 | 1.356E-06 | 6.152E-04 | 2.911E-09 | 9.612E-06 | 9.612E-06 |
| Benzylchloride | ND | ND | ND | ND | ND | ND | ND | ND |
| m-Dichlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| p-Dichlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| o-Dichlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2,4-Trichlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| Hexachlorobutadiene | ND | ND | ND | ND | ND | ND | ND | ND |
| trans-1,2-Dichloroethene | ND | ND | ND | ND | ND | ND | ND | ND |
| o-Chlorotoluene | ND | ND | ND | ND | ND | ND | ND | ND |
| p-Chlorotoluene | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,3,5-Trichlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2,3-Trichlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| Methylnitrite | 4.068E-04 | 3.025E-04 | 7.992E-07 | 2.318E-07 | 1.051E-04 | 4.974E-10 | 1.643E-06 | 1.643E-06 |
| Acetonitrile | 4.976E-04 | ND | 3.813E-06 | 1.106E-06 | 5.016E-04 | 2.373E-09 | 7.838E-06 | 7.838E-06 |
| Acrylonitrile | 3.813E-04 | ND | 2.922E-06 | 8.473E-07 | 3.843E-04 | 1.818E-09 | 6.005E-06 | 6.005E-06 |
| Nitromethane | 7.151E-04 | 4.677E-04 | 1.896E-06 | 5.500E-07 | 2.495E-04 | 1.180E-09 | 3.898E-06 | 3.898E-06 |
| Benzonitrile | 2.149E-04 | ND | 1.647E-06 | 4.775E-07 | 2.166E-04 | 1.025E-09 | 3.384E-06 | 3.384E-06 |
| Nitrobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| Carbonyl Sulfide | 2.057E-04 | ND | 1.576E-06 | 4.570E-07 | 2.073E-04 | 9.808E-10 | 3.239E-06 | 3.239E-06 |
| Sulfur Dioxide | ND | ND | ND | ND | ND | ND | ND | ND |
| Carbon Disulfide | 6.686E-03 | 5.214E-04 | 4.724E-05 | 1.370E-05 | 6.214E-03 | 2.940E-08 | 9.709E-05 | 9.709E-05 |
| Thiophene | 2.582E-04 | ND | 1.979E-06 | 5.739E-07 | 2.603E-04 | 1.232E-09 | 4.067E-06 | 4.067E-06 |
| Dimethyldisulfide | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Methylthiophene | ND | ND | ND | ND | ND | ND | ND | ND |
| 3-Methylthiophene | ND | ND | ND | ND | ND | ND | ND | ND |

## Table B-2: Air Modeling Output Data for Volatile Organic Compounds

| Compound | Measured Actual Concentration ($mg/m^3$) | Measured Background Concentration ($mg/m^3$) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted (grams/item) M | Pollutant Concentration 1 Item ($grams/m^3$) CONC | Pollutant Emission Rate (g/sec)/item $ER_1$ | Event Pollutant Emission Rate 1 Item (g/sec) $ER_{EV}$ |
|---|---|---|---|---|---|---|---|---|
| Dimethyltrisulfide | ND | ND | ND | ND | ND | ND | ND | ND |
| Isothiocyanatomethane | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Chlorothiophene | ND | ND | ND | ND | ND | ND | ND | ND |
| 3-Chlorothiophene | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Thiophenecarboxaldehyde | ND | ND | ND | ND | ND | ND | ND | ND |
| Naphthalene | 3.274E-04 | ND | 2.509E-06 | 7.275E-07 | 3.300E-04 | 1.561E-09 | 5.156E-06 | 5.156E-06 |
| Acetaldehyde | 6.358E-04 | ND | 4.872E-06 | 1.413E-06 | 6.409E-04 | 3.032E-09 | 1.001E-05 | 1.001E-05 |
| Acrolein | 2.649E-04 | ND | 2.030E-06 | 5.888E-07 | 2.671E-04 | 1.264E-09 | 4.173E-06 | 4.173E-06 |
| Acetone | 7.386E-03 | 8.413E-03 | ND | ND | ND | ND | ND | ND |
| Propanal | 6.012E-04 | ND | 4.607E-06 | 1.336E-06 | 6.060E-04 | 2.867E-09 | 9.468E-06 | 9.468E-06 |
| Furan | 2.643E-04 | ND | 2.025E-06 | 5.874E-07 | 2.664E-04 | 1.261E-09 | 4.163E-06 | 4.163E-06 |
| 2-Propanol | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Methylpropanal | ND | ND | ND | ND | ND | ND | ND | ND |
| Methacrolein | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,3-Butanedione | ND | ND | ND | ND | ND | ND | ND | ND |
| Methyl-Vinyl Ketone | ND | ND | ND | ND | ND | ND | ND | ND |
| **MTBE** | 8.816E-04 | 8.413E-04 | 3.089E-07 | 8.959E-08 | 4.064E-05 | 1.923E-10 | 6.349E-07 | 6.349E-07 |
| Butanal | 9.798E-04 | 6.832E-04 | 2.273E-06 | 6.591E-07 | 2.989E-04 | 1.414E-09 | 4.671E-06 | 4.671E-06 |
| 2-Butanone | 1.253E-03 | 7.843E-04 | 3.590E-06 | 1.041E-06 | 4.722E-04 | 2.234E-09 | 7.378E-06 | 7.378E-06 |
| Tetrahydrofuran | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Methyl-1-propanol | ND | ND | ND | ND | ND | ND | ND | ND |
| trans-2-Butenal | ND | ND | ND | ND | ND | ND | ND | ND |
| Acetic Acid | 1.378E-03 | 8.749E-04 | 3.856E-06 | 1.118E-06 | 5.073E-04 | 2.400E-09 | 7.926E-06 | 7.926E-06 |
| 2-Pentanone | 1.642E-03 | 1.061E-03 | 4.453E-06 | 1.291E-06 | 5.858E-04 | 2.772E-09 | 9.153E-06 | 9.153E-06 |
| Pentanal | 1.606E-03 | 1.560E-03 | 3.598E-07 | 1.044E-07 | 4.733E-05 | 2.239E-10 | 7.396E-07 | 7.396E-07 |
| 4-Methyl-2-pentanone | ND | ND | ND | ND | ND | ND | ND | ND |
| trans-2-Pentenal | ND | ND | ND | ND | ND | ND | ND | ND |
| Cyclopentanone | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Hexanone | 2.181E-04 | ND | 1.671E-06 | 4.847E-07 | 2.198E-04 | 1.040E-09 | 3.435E-06 | 3.435E-06 |
| Hexanal | 5.276E-04 | 9.664E-04 | ND | ND | ND | ND | ND | ND |
| 3-Furaldehyde | ND | ND | ND | ND | ND | ND | ND | ND |
| Butyl Acetate | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Furaldehyde | ND | ND | ND | ND | ND | ND | ND | ND |
| trans-2-Hexenal | ND | ND | ND | ND | ND | ND | ND | ND |
| 1-Hexanol | ND | ND | ND | ND | ND | ND | ND | ND |
| 3-Heptanone | 5.014E-04 | ND | 3.842E-06 | 1.114E-06 | 5.054E-04 | 2.391E-09 | 7.897E-06 | 7.897E-06 |

## Table B-2: Air Modeling Output Data for Volatile Organic Compounds

| Compound | Measured Actual Concentration ($mg/m^3$) | Measured Background Concentration ($mg/m^3$) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted (grams/item) M | Pollutant Concentration 1 Item ($grams/m^3$) CONC | Pollutant Emission Rate (g/sec)/item $ER_1$ | Event Pollutant Emission Rate 1 Item (g/sec) $ER_{EV}$ |
|---|---|---|---|---|---|---|---|---|
| 2-Heptanone | ND | ND | ND | ND | ND | ND | ND | ND |
| Heptanal | 6.160E-04 | 1.281E-03 | ND | ND | ND | ND | ND | ND |
| trans-2-Heptenal | ND | ND | ND | ND | ND | ND | ND | ND |
| 5-Methyl-2-furaldehyde | ND | ND | ND | ND | ND | ND | ND | ND |
| 6-Methyl-2-heptanone | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzaldehyde | 1.272E-03 | 1.037E-03 | 1.798E-06 | 5.214E-07 | 2.365E-04 | 1.119E-09 | 3.695E-06 | 3.695E-06 |
| 1-Heptanol | ND | ND | ND | ND | ND | ND | ND | ND |
| 6-Methyl-5-hepten-2-one | ND | 5.975E-04 | ND | ND | ND | ND | ND | ND |
| 2-Octanone | ND | ND | ND | ND | ND | ND | ND | ND |
| Octanal | 1.874E-03 | 2.740E-03 | ND | ND | ND | ND | ND | ND |
| Benzofuran | ND | ND | ND | ND | ND | ND | ND | ND |
| trans-2-Octenal | ND | ND | ND | ND | ND | ND | ND | ND |
| Acetophenone | 4.455E-04 | 3.578E-04 | 6.720E-07 | 1.949E-07 | 8.840E-05 | 4.182E-10 | 1.381E-06 | 1.381E-06 |
| 2-Nonanone | ND | ND | ND | ND | ND | ND | ND | ND |
| Nonanal | 3.308E-03 | 1.519E-03 | 1.371E-05 | 3.976E-06 | 1.803E-03 | 8.533E-09 | 2.818E-05 | 2.818E-05 |
| trans-2-Nonenal | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Decanone | ND | ND | ND | ND | ND | ND | ND | ND |
| Decanal | 2.662E-03 | ND | 2.040E-05 | 5.91626E-06 | 2.684E-03 | 1.270E-08 | 4.193E-05 | 4.193E-05 |

Footnotes:

ND = Not Detected

NEW = Net Explosive Weight

**Items in bold represent duplicate values for those compounds that are common for Method TO-14 and TO-12.**

## Table B-3: Air Modeling Output Data for Semi-Volatile Organic Compounds

| | Red Parachute Signal Flare | | | | Items per event (I): | 1 | item/event | |
|---|---|---|---|---|---|---|---|---|
| | NEW, lb = 0.29 | | | | release duration (t): | 64 | seconds | |
| | Number of Items = 1 | | | | Unit Concentration (UC): | 3.028E-04 | $g/m^3/(g/s)$ | |
| Compound | Measured Actual Concentration ($mg/m^3$) | Measured Background Concentration ($mg/m^3$) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted (grams/item) M | Pollutant Concentration 1 Item ($grams/m^3$) CONC | Pollutant Emission Rate (g/sec)/item $ER_1$ | Event Pollutant Emission Rate 1 Item (g/sec) $ER_{EV}$ |
| **Particulate/Vapor-phase SVOCs** | | | | | | | | |
| N-Nitrosodimethylamine | ND | ND | ND | ND | ND | ND | ND | ND |
| Pyridine | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Picoline | ND | ND | ND | ND | ND | ND | ND | ND |
| Methyl methanesulfonate | ND | ND | ND | ND | ND | ND | ND | ND |
| N-Nitrosomethylethylamine | ND | ND | ND | ND | ND | ND | ND | ND |
| N-Nitrosodiethylamine | ND | ND | ND | ND | ND | ND | ND | ND |
| Ethyl methanesulfonate | ND | ND | ND | ND | ND | ND | ND | ND |
| Phenol | ND | ND | ND | ND | ND | ND | ND | ND |
| Aniline | ND | ND | ND | ND | ND | ND | ND | ND |
| bis(2-Chloroethyl)ether | ND | ND | ND | ND | ND | ND | ND | ND |
| Pentachloroethane | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Chlorophenol | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,3-Dichlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,4-Dichlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzyl alcohol | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Methylphenol | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2-Dichlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| bis(2-Chloroisopropyl)ether | ND | ND | ND | ND | ND | ND | ND | ND |
| o-Toluidine | ND | ND | ND | ND | ND | ND | ND | ND |
| 4-Methylphenol/3-Methylphenol | ND | ND | ND | ND | ND | ND | ND | ND |
| N-Nitroso-di-n-propylamine | ND | ND | ND | ND | ND | ND | ND | ND |
| Acetophenone | 1.279E-03 | 3.066E-04 | 7.967E-06 | 2.310E-06 | 1.048E-03 | 4.958E-09 | 1.637E-05 | 1.637E-05 |
| N-Nitrosomorpholine | ND | ND | ND | ND | ND | ND | ND | ND |
| N-Nitrosopyrrolidine | ND | ND | ND | ND | ND | ND | ND | ND |
| Hexachloroethane | ND | ND | ND | ND | ND | ND | ND | ND |
| Nitrobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| N-Nitrosopiperidine | ND | ND | ND | ND | ND | ND | ND | ND |
| Isophorone | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4-Dimethylphenol | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Nitrophenol | ND | ND | ND | ND | ND | ND | ND | ND |
| bis(2-Chloroethoxy)methane | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzoic acid | 3.493E-03 | 2.394E-03 | 9.012E-06 | 2.613E-06 | 1.185E-03 | 5.609E-09 | 1.852E-05 | 1.852E-05 |

## Table B-3: Air Modeling Output Data for Semi-Volatile Organic Compounds

| Compound | Measured Actual Concentration ($mg/m^3$) | Measured Background Concentration ($mg/m^3$) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted (grams/item) M | Pollutant Concentration 1 Item (grams/$m^3$) CONC | Pollutant Emission Rate (g/sec)/item $ER_i$ | Event Pollutant Emission Rate 1 Item (g/sec) $ER_{EV}$ |
|---|---|---|---|---|---|---|---|---|
| 2,4-Dichlorophenol | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2,4-Trichlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| Naphthalene | ND | ND | ND | ND | ND | ND | ND | ND |
| p-Chloroaniline | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,6-Dichlorophenol | ND | ND | ND | ND | ND | ND | ND | ND |
| Hexachloropropene | ND | ND | ND | ND | ND | ND | ND | ND |
| Hexachlorobutadiene | ND | ND | ND | ND | ND | ND | ND | ND |
| Dimethylphenethylamine | ND | ND | ND | ND | ND | ND | ND | ND |
| N-Nitroso-di-n-butylamine | ND | ND | ND | ND | ND | ND | ND | ND |
| 4-Chloro-3-methylphenol | ND | ND | ND | ND | ND | ND | ND | ND |
| Safrole | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Methylnaphthalene | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2,4,5-Tetrachlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| Hexachlorocyclopentadiene | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4,6-Trichlorophenol | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4,5-Trichlorophenol | ND | ND | ND | ND | ND | ND | ND | ND |
| Isosafrole | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Chloronaphthalene | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Nitroaniline | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,4-Naphthoquinone | ND | ND | ND | ND | ND | ND | ND | ND |
| Dimethylphthalate | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,3-Dinitrobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,6-Dinitrotoluene | ND | ND | ND | ND | ND | ND | ND | ND |
| Acenaphthylene | ND | ND | ND | ND | ND | ND | ND | ND |
| 3-Nitroaniline | ND | ND | ND | ND | ND | ND | ND | ND |
| 4-Nitrophenol | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4-Dinitrophenol | ND | ND | ND | ND | ND | ND | ND | ND |
| Acenaphthene | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4-Dinitrotoluene | ND | ND | ND | ND | ND | ND | ND | ND |
| Dibenzofuran | ND | ND | ND | ND | ND | ND | ND | ND |
| Pentachlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| 1-Naphthylamine | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Naphthylamine | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,3,4,6-Tetrachlorophenol | ND | ND | ND | ND | ND | ND | ND | ND |
| Diethylphthalate | 7.303E-04 | 5.896E-04 | 1.153E-06 | 3.345E-07 | 1.517E-04 | 7.177E-10 | 2.370E-06 | 2.370E-06 |
| 4-Chlorophenylphenyl ether | ND | ND | ND | ND | ND | ND | ND | ND |

## Table B-3: Air Modeling Output Data for Semi-Volatile Organic Compounds

| Compound | Measured Actual Concentration ($mg/m^3$) | Measured Background Concentration ($mg/m^3$) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted (grams/item) M | Pollutant Concentration 1 Item ($grams/m^3$) CONC | Pollutant Emission Rate (g/sec)/item $ER_1$ | Event Pollutant Emission Rate 1 Item (g/sec) $ER_{EV}$ |
|---|---|---|---|---|---|---|---|---|
| Fluorene | ND | ND | ND | ND | ND | ND | ND | ND |
| 5-Nitro-o-toluidine | ND | ND | ND | ND | ND | ND | ND | ND |
| 4-Nitroaniline | ND | ND | ND | ND | ND | ND | ND | ND |
| 4,6-Dinitro-2-methylphenol | ND | ND | ND | ND | ND | ND | ND | ND |
| Diphenylamine/N-NitrosoDPA | ND | ND | ND | ND | ND | ND | ND | ND |
| sym-Trinitrobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| Diallate | ND | ND | ND | ND | ND | ND | ND | ND |
| Phenacetin | ND | ND | ND | ND | ND | ND | ND | ND |
| 4-Bromophenylphenyl ether | ND | ND | ND | ND | ND | ND | ND | ND |
| Hexachlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| 4-Aminobiphenyl | ND | ND | ND | ND | ND | ND | ND | ND |
| Pronamide | ND | ND | ND | ND | ND | ND | ND | ND |
| Pentachlorophenol | ND | ND | ND | ND | ND | ND | ND | ND |
| Pentachloronitrobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| Phenanthrene | ND | ND | ND | ND | ND | ND | ND | ND |
| Anthracene | ND | ND | ND | ND | ND | ND | ND | ND |
| Carbazole | ND | ND | ND | ND | ND | ND | ND | ND |
| Di-n-butylphthalate | 1.494E-03 | 1.957E-03 | ND | ND | ND | ND | ND | ND |
| 4-Nitroquinoline-1-oxide | ND | ND | ND | ND | ND | ND | ND | ND |
| Methapyrilene | ND | ND | ND | ND | ND | ND | ND | ND |
| Fluoranthene | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzidine | ND | ND | ND | ND | ND | ND | ND | ND |
| Pyrene | ND | ND | ND | ND | ND | ND | ND | ND |
| p-Dimethylaminoazobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| Chlorobenzilate | ND | ND | ND | ND | ND | ND | ND | ND |
| Kepone | ND | ND | ND | ND | ND | ND | ND | ND |
| Butylbenzylphthalate | 3.452E-04 | ND | 2.829E-06 | 8.205E-07 | 3.722E-04 | 1.761E-09 | 5.815E-06 | 5.815E-06 |
| 3,3'-Dimethylbenzidine | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Acetylaminofluorene | ND | ND | ND | ND | ND | ND | ND | ND |
| bis(2-Ethylhexyl)phthalate | 7.511E-04 | 5.277E-04 | 1.831E-06 | 5.311E-07 | 2.409E-04 | 1.140E-09 | 3.764E-06 | 3.764E-06 |
| 3,3'-Dichlorobenzidine | ND | ND | ND | ND | ND | ND | ND | ND |
| Benz(a)anthracene | ND | ND | ND | ND | ND | ND | ND | ND |
| Chrysene | ND | ND | ND | ND | ND | ND | ND | ND |
| Di-n-octylphthalate | 2.065E-04 | ND | 1.693E-06 | 4.909E-07 | 2.227E-04 | 1.054E-09 | 3.479E-06 | 3.479E-06 |
| 7,12-Dimethylbenz(a)anthracene | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzo(b)fluoranthene | ND | ND | ND | ND | ND | ND | ND | ND |

## Table B-3: Air Modeling Output Data for Semi-Volatile Organic Compounds

| Compound | Measured Actual Concentration ($mg/m^3$) | Measured Background Concentration ($mg/m^3$) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted (grams/item) M | Pollutant Concentration 1 Item ($grams/m^3$) CONC | Pollutant Emission Rate (g/sec)/item $ER_1$ | Event Pollutant Emission Rate 1 Item (g/sec) $ER_{EV}$ |
|---|---|---|---|---|---|---|---|---|
| Benzo(k)fluoranthene | ND | ND | ND | ND | ND | ND | ND | ND |
| Benz(a)pyrene | ND | ND | ND | ND | ND | ND | ND | ND |
| 3-Methylcholanthrene | ND | ND | ND | ND | ND | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | ND | ND | ND | ND | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzo(g,h,i)perylene | ND | ND | ND | ND | ND | ND | ND | ND |

Footnotes:
ND = Not Detected
NEW = Net Explosive Weight

# APPENDIX C

# HEALTH-BASED SCREENING LEVELS AND ACUTE TOXICITY VALUES

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| | | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Compound | CAS # | Region 9 PRG ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Region 3 RBC ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Health-based Screening Level ($\mu g/m^3$) | ERPG ($\mu g/m^3$) | TEEL ($\mu g/m^3$) | Source (T or E) | Acute Toxicity Value ($\mu g/m^3$) |
| TSP | 12789-66-1 | 5.00E+01 | | NA | | 5.00E+01 | NA | NA | | |
| $PM_{10}$ | | 5.00E+01 | | NA | | 5.00E+01 | NA | NA | | |
| HCl | 7647-01-0 | 2.08E+01 | nc | 2.08E+01 | nc | 2.08E+01 | NA | 7.14E+03 | T | 7.14E+03 |
| $Cl_2$ | 7782-50-5 | 2.09E-01 | nc | 3.65E+02 | nc | 2.09E-01 | 2.89E+03 | 2.90E+03 | E | 2.89E+03 |
| Dioxin TEQ | 1746-01-6 | 4.48E-08 | c | 4.48E-08 | c | 4.48E-08 | NA | 3.50E+00 | T | 3.50E+00 |
| Carbon Monoxide (CO) | 630-08-0 | 1.57E+02 | | NA | | 1.57E+02 | 2.30E+05 | 2.28E+05 | E | 2.30E+05 |
| Nitrogen Oxide (NOx) | 10024-97-2 | 1.00E+02 | | NA | | 1.00E+02 | NA | 2.70E+05 | T | 2.70E+05 |
| HCl (CEM System) | 7647-01-0 | 2.08E+01 | nc | 2.08E+01 | nc | 2.08E+01 | NA | 7.14E+03 | T | 7.14E+03 |
| Carbon Dioxide ($CO_2$) | 124-38-9 | NA | | NA | | NA | NA | 5.40E+07 | T | 5.40E+07 |
| Sulfur Dioxide ($SO_2$) | 202-58-84 | 8.00E+01 | | NA | | 8.00E+01 | 7.89E+02 | 7.86E+02 | E | 7.89E+02 |
| Aluminum | 7429-90-5 | NA | | 3.65E+00 | nc | 3.65E+00 | NA | 3.00E+04 | T | 3.00E+04 |
| Antimony | 7440-36-0 | NA | | 1.46E+00 | nc | 1.46E+00 | NA | 1.50E+03 | T | 1.50E+03 |
| Arsenic | 7440-38-2 | 4.47E-04 | c | 4.15E-04 | c | 4.47E-04 | NA | 3.00E+01 | T | 3.00E+01 |
| Barium | 7440-39-3 | 5.21E-01 | nc | 5.11E-01 | nc | 5.21E-01 | NA | 1.50E+03 | T | 1.50E+03 |
| Beryllium | 7440-41-7 | 8.00E-04 | c | 7.45E-04 | c | 8.00E-04 | NA | 5.00E+00 | T | 5.00E+00 |
| Cadmium | 7440-43-9 | 1.07E-03 | c | 9.94E-04 | c | 1.07E-03 | NA | 3.00E+01 | T | 3.00E+01 |
| Chromium | 7440-43-9 | NA | c | 1.53E-04 | c | 1.53E-04 | NA | 1.50E+03 | T | 1.50E+03 |
| Cobalt | 7440-48-4 | NA | | 2.20E+02 | nc | 2.20E+02 | NA | 6.00E+01 | T | 6.00E+01 |
| Copper | 7440-50-8 | NA | | 1.46E+02 | nc | 1.46E+02 | NA | 3.00E+03 | T | 3.00E+03 |
| Lead | 7439-92-1 | 1.50E+00 | | NA | | 1.50E+00 | NA | 1.50E+02 | T | 1.50E+02 |
| Magnesium | 7439-95-4 | NA | | NA | | NA | NA | 3.00E+04 | T | 3.00E+04 |
| Manganese | 7439-96-5 | 5.11E-02 | nc | 5.22E-02 | nc | 5.11E-02 | NA | 3.00E+03 | T | 3.00E+03 |
| Nickel | 7440-02-0 | NA | | 7.30E+01 | nc | 7.30E+01 | NA | 3.00E+03 | T | 3.00E+03 |
| Phosphorus | 7723-14-0 | NA | | NA | | NA | NA | 3.00E+02 | T | 3.00E+02 |
| Selenium | 7782-49-2 | NA | | 1.83E+01 | nc | 1.83E+01 | NA | 6.00E+02 | T | 6.00E+02 |
| Silver | 7740-22-4 | NA | | 1.83E+01 | nc | 1.83E+01 | NA | 3.00E+02 | T | 3.00E+02 |
| Thallium | 7440-28-0 | NA | | 2.56E-01 | nc | 2.56E-01 | NA | 3.00E+02 | T | 3.00E+02 |
| Zinc | 7440-66-6 | NA | | 1.10E+03 | nc | 1.10E+03 | NA | 3.00E+04 | T | 3.00E+04 |
| Mercury | 7439-97-6 | 3.13E-01 | nc | 3.14E-01 | nc | 3.13E-01 | NA | 1.00E+02 | T | 1.00E+02 |
| TNMHC | | NA | | NA | | NA | NA | NA | | |
| Ethane | 74-84-0 | NA | | NA | | NA | NA | NA | | |
| Ethylene | 74-85-1 | NA | | NA | | NA | NA | 4.60E+05 | T | 4.60E+05 |
| Acetylene | 74-86-2 | NA | | NA | | NA | NA | NA | | |
| Propane | 74-98-6 | NA | | NA | | NA | NA | 3.78E+06 | T | 3.78E+06 |
| Propene | 115-07-1 | NA | | NA | | NA | NA | NA | | |
| i-Butane | 106-97-8 | NA | | NA | | NA | NA | 5.71E+06 | T | 5.71E+06 |
| i-Butene | 25167-67-3 | NA | | NA | | NA | NA | NA | | |
| 1-Butene | 106-98-9 | NA | | NA | | NA | NA | NA | | |
| 1,3-Butadiene | 106-99-0 | 3.74E-03 | c | 3.48E-03 | c | 3.74E-03 | 2.20E+04 | 2.21E+04 | E | 2.20E+04 |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| Compound | CAS # | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Region 9 PRG ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Region 3 RBC ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Health-based Screening Level ($\mu g/m^3$) | ERPG ($\mu g/m^3$) | TEEL ($\mu g/m^3$) | Source (T or E) | Acute Toxicity Value ($\mu g/m^3$) |
| n-Butane | 106-97-8 | NA | | NA | | NA | NA | 5.71E+06 | T | 5.71E+06 |
| trans-2-Butene | 624-64-6 | NA | | NA | | NA | NA | NA | | |
| 2,2-Dimethylpropane | 463-82-1 | NA | | NA | | NA | NA | NA | | |
| cis-2-Butene | 590-18-1 | NA | | NA | | NA | NA | NA | | |
| 3-Methyl-1-butene | 563-45-1 | NA | | NA | | NA | NA | NA | | |
| i-Pentane | 109-66-0 | NA | | NA | | NA | NA | 1.80E+06 | T | 1.80E+06 |
| 1-Pentene | 109-67-1 | NA | | NA | | NA | NA | NA | | |
| 2-Methyl-1-butene | 563-46-2 | NA | | NA | | NA | NA | NA | | |
| n-Pentane | 109-66-0 | NA | | NA | | NA | NA | 1.80E+06 | T | 1.80E+06 |
| Isoprene | 78-79-5 | NA | | NA | | NA | NA | NA | | |
| trans-2-Pentene | 646-04-8 | NA | | NA | | NA | NA | NA | | |
| cis-2-Pentene | 627-20-3 | NA | | NA | | NA | NA | NA | | |
| 2-Methyl-2-butene | 513-35-9 | NA | | NA | | NA | NA | NA | | |
| 2,2-Dimethylbutane | 75-83-2 | NA | | NA | | NA | NA | 1.80E+06 | T | 1.80E+06 |
| Cyclopentene | 142-29-0 | NA | | NA | | NA | NA | NA | | |
| 4-Methyl-1-pentene | 691-37-2 | NA | | NA | | NA | NA | NA | | |
| Cyclopentane | 287-92-3 | NA | | NA | | NA | NA | NA | | |
| 2,3-Dimethylbutane | 79-29-8 | NA | | NA | | NA | NA | NA | | |
| cis-4-Methyl-2-pentene | 691-38-3 | NA | | NA | | NA | NA | NA | | |
| 2-Methylpentane | 107-83-5 | NA | | NA | | NA | NA | 1.80E+06 | T | 1.80E+06 |
| 3-Methylpentane | 96-14-0 | NA | | NA | | NA | NA | NA | | |
| 2-Methyl-1-pentene | 763-29-1 | NA | | NA | | NA | NA | NA | | |
| 1-Hexene | 592-41-6 | NA | | NA | | NA | NA | 1.03E+05 | T | 1.03E+05 |
| n-Hexane | 110-54-3 | 2.10E+02 | nc | 2.1E+02 | nc | 2.10E+02 | NA | 5.28E+05 | T | 5.28E+05 |
| trans-2-Hexene | 4050-45-7 | NA | | NA | | NA | NA | NA | | |
| 2-Methyl-2-pentene | 625-27-4 | NA | | NA | | NA | NA | NA | | |
| cis-2-Hexene | 7688-21-3 | NA | | NA | | NA | NA | NA | | |
| Methylcyclopentane | 96-37-7 | NA | | NA | | NA | NA | NA | | |
| 2,4-Dimethylpentane | 108-08-7 | NA | | NA | | NA | NA | NA | | |
| Benzene | 71-43-2 | 2.50E-01 | c | 2.2E-01 | c | 2.50E-01 | 1.56E+05 | 1.60E+05 | E | 1.56E+05 |
| Cyclohexane | 110-82-7 | NA | | NA | | NA | NA | 3.10E+06 | T | 3.10E+06 |
| 2-Methylhexane | 591-76-4 | NA | | NA | | NA | NA | NA | | |
| 2,3-Dimethylpentane | 565-59-3 | NA | | NA | | NA | NA | NA | | |
| 3-Methylhexane | 589-34-4 | NA | | NA | | NA | NA | NA | | |
| 2,2,4-Trimethylpentane | 540-84-1 | NA | | NA | | NA | NA | 3.50E+05 | T | 3.50E+05 |
| n-Heptane | 142-82-5 | NA | | NA | | NA | NA | 1.80E+06 | T | 1.80E+06 |
| 2,4,4-Trimethyl-1-pentene | 107-39-1 | NA | | NA | | NA | NA | NA | | |
| Methylcyclohexane | 108-87-2 | 3.10E+03 | nc | 3.1E+03 | nc | 3.10E+03 | NA | 4.81E+06 | T | 4.81E+06 |
| 2,4,4-Trimethyl-2-pentene | 107-40-4 | NA | | NA | | NA | NA | NA | | |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| | | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Compound | CAS # | Region 9 PRG ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Region 3 RBC ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Health-based Screening Level ($\mu g/m^3$) | ERPG ($\mu g/m^3$) | TEEL ($\mu g/m^3$) | Source (T or E) | Acute Toxicity Value ($\mu g/m^3$) |
| 2,5-Dimethylhexane | 592-13-2 | NA | | NA | | NA | NA | NA | | |
| 2,4-Dimethylhexane | 589-43-5 | NA | | NA | | NA | NA | NA | | |
| 2,3,4-Trimethylpentane | 565-59-3 | NA | | NA | | NA | NA | NA | | |
| Toluene | 108-88-3 | 4.02E+02 | nc | 4.16E+02 | nc | 4.02E+02 | 1.88E+05 | 1.89E+05 | E | 1.88E+05 |
| 2,3-Dimethylhexane | 584-94-1 | NA | | NA | | NA | NA | NA | | |
| 2-Methylheptane | 592-27-8 | NA | | NA | | NA | NA | NA | | |
| 3-Ethylhexane | 619-99-8 | NA | | NA | | NA | NA | NA | | |
| 2,2-Dimethylheptane | 1071-26-7 | NA | | NA | | NA | NA | NA | | |
| 2,2,4-Trimethylhexane | 16747-26-5 | NA | | NA | | NA | NA | NA | | |
| n-Octane | 111-65-9 | NA | | NA | | NA | NA | NA | | |
| Ethylcyclohexane | 1678-91-7 | NA | | NA | | NA | NA | NA | | |
| Ethylbenzene | 100-41-4 | 1.10E+03 | nc | 1.1E+03 | nc | 1.10E+03 | NA | 5.43E+05 | T | 5.43E+05 |
| m-Xylene & p-Xylene | 108-38-3 | NA | | NA | | NA | NA | 6.51E+05 | T | 6.51E+05 |
| Styrene | 100-42-5 | 1.10E+03 | nc | 1.0E+03 | nc | 1.10E+03 | 2.13E+05 | 2.13E+05 | E | 2.13E+05 |
| o-Xylene | 95-47-6 | NA | | 7.3E+03 | nc | 7.30E+03 | NA | 6.51E+05 | T | 6.51E+05 |
| n-Nonane | 111-84-2 | NA | | 4.0E+02 | nc | 4.02E+02 | NA | 1.05E+06 | T | 1.05E+06 |
| i-Propylbenzene | 98-82-8 | 4.00E+02 | nc | 4.0E+02 | nc | 4.00E+02 | NA | NA | | |
| n-Propylbenzene | 103-65-1 | 3.65E+01 | nc | 1.5E+02 | nc | 3.65E+01 | NA | NA | | |
| p-Ethyltoluene | 622-96-8 | NA | | NA | | NA | NA | 1.25E+05 | T | 1.25E+05 |
| m-Ethyltoluene | 620-14-4 | NA | | NA | | NA | NA | NA | | |
| 1,3,5-Trimethylbenzene | 108-67-8 | 6.20E+00 | nc | 6.2E+00 | nc | 6.20E+00 | NA | 3.68E+05 | T | 3.68E+05 |
| o-Ethyltoluene | 611-14-3 | NA | | NA | | NA | NA | 7.50E+02 | T | 7.50E+02 |
| 1,2,4-Trimethylbenzene & sec-Butylbenzene | 95-63-6 | 6.21E+00 | nc | 6.21E+00 | nc | 6.21E+00 | NA | 1.80E+05 | T | 1.80E+05 |
| n-Decane | 124-18-5 | NA | | NA | | NA | NA | 4.37E+03 | T | 4.37E+03 |
| alpha-Pinene | 80-56-8 | NA | | NA | | NA | NA | 4.00E+04 | T | 4.00E+04 |
| beta-Pinene | 127-91-3 | NA | | NA | | NA | NA | NA | | |
| delta 3-Carene | 13466-78-9 | NA | | NA | | NA | NA | NA | | |
| d-Limonene | 5989-27-5 | NA | | NA | | NA | NA | 1.95E+06 | T | 1.95E+06 |
| MTBE | 1634-04-4 | 3.10E+03 | nc | 3.1E+03 | nc | 3.10E+03 | NA | 4.32E+05 | T | 4.32E+05 |
| Dichlorodifluoromethane | 75-71-8 | 2.10E+02 | nc | 1.8E+02 | nc | 2.10E+02 | NA | 1.48E+07 | T | 1.48E+07 |
| Methylchloride | 74-87-33 | NA | | NA | | NA | NA | NA | | |
| Dichlorotetrafluoroethane | 374-07-2 | NA | | NA | | NA | NA | NA | | |
| Chloroethene | 75-01-4 | 2.20E-02 | c | 2.1E-02 | c | 2.20E-02 | NA | 1.28E+04 | T | 1.28E+04 |
| 1,3-Butadiene | 106-99-0 | 3.74E-03 | c | 3.48E-03 | c | 3.74E-03 | 2.20E+04 | 2.21E+04 | E | 2.20E+04 |
| Methylbromide | 74-83-9 | 5.20E+00 | nc | 5.1E+00 | nc | 5.20E+00 | NA | 5.82E+04 | T | 5.82E+04 |
| Ethylchloride | 75-00-3 | 2.30E+00 | c | 2.2E+00 | c | 2.30E+00 | NA | 7.92E+06 | T | 7.92E+06 |
| Trichloromonofluoromethane | 75-69-4 | 7.30E+02 | nc | 7.30E+02 | nc | 7.30E+02 | NA | 2.81E+06 | T | 2.81E+06 |
| Vinylidene chloride | 75-35-4 | NA | | NA | | NA | NA | 7.92E+04 | T | 7.92E+04 |
| Methylene chloride | 75-09-2 | 4.10E+00 | c | 3.8E+00 | c | 4.10E+00 | 6.96E+05 | 6.94E+05 | E | 6.96E+05 |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| | | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Compound | CAS # | Region 9 PRG ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Region 3 RBC ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Health-based Screening Level ($\mu g/m^3$) | ERPG ($\mu g/m^3$) | TEEL ($\mu g/m^3$) | Source (T or E) | Acute Toxicity Value ($\mu g/m^3$) |
| Allyl chloride | 107-05-1 | 1.00E+00 | nc | NA | | 1.00E+00 | 9.39E+03 | 9.39E+03 | E | 9.39E+03 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | 76-13-1 | 3.13E+04 | nc | 3.14E+04 | nc | 3.13E+04 | NA | 9.58E+06 | T | 9.58E+06 |
| 1,1-Dichloroethane | 75-34-3 | 5.21E+02 | nc | 5.11E+02 | nc | 5.21E+02 | NA | 1.21E+06 | T | 1.21E+06 |
| 1,2-Dichloroethene | 540-59-0 | NA | | 3.29E+01 | nc | 3.29E+01 | NA | 2.38E+06 | T | 2.38E+06 |
| Chloroform | 67-66-3 | 8.40E-02 | c | 2.2E+00 | c | 8.40E-02 | NA | 9.76E+03 | T | 9.76E+03 |
| 1,2-Dichloroethane | 107-06-2 | 7.39E-02 | c | 6.88E-02 | c | 7.39E-02 | NA | 8.08E+03 | T | 8.08E+03 |
| Methylchloroform | 71-55-6 | 1.00E+03 | nc | 2.3E+03 | nc | 1.00E+03 | NA | 1.91E+06 | T | 1.91E+06 |
| Benzene | 71-43-2 | 2.50E-01 | c | 2.2E-01 | c | 2.50E-01 | NA | 1.60E+05 | T | 1.60E+05 |
| Carbontetrachloride | 56-23-5 | 1.04E+03 | nc | 1.04E+03 | nc | 1.04E+03 | 1.28E+05 | 1.26E+05 | E | 1.28E+05 |
| 1,2-Dichloropropane | 78-87-5 | 9.89E-02 | c | 9.21E-02 | c | 9.89E-02 | NA | 5.08E+05 | T | 5.08E+05 |
| Trichloroethylene | 79-01-6 | 1.12E+00 | c | 1.04E+00 | c | 1.12E+00 | NA | 5.37E+05 | T | 5.37E+05 |
| cis 1,3-Dichloro-1-propene | 10061-01-5 | NA | | NA | | NA | NA | 1.14E+04 | T | 1.14E+04 |
| trans 1,3-Dichloro-1-propene | 10061-02-6 | NA | | NA | | NA | NA | NA | | |
| 1,1,2-Trichloroethane | 79-00-5 | 1.20E-01 | c | 1.12E-01 | c | 1.20E-01 | NA | 1.64E+05 | T | 1.64E+05 |
| Toluene | 108-88-3 | 4.02E+02 | nc | 4.16E+02 | nc | 4.02E+02 | 1.88E+05 | 1.89E+05 | E | 1.88E+05 |
| 1,2-Dibromoethane | 106-93-4 | 8.73E-03 | c | 8.24E-03 | c | 8.73E-03 | NA | 1.54E+05 | T | 1.54E+05 |
| Perchloroethylene | 127-18-4 | 3.31E+00 | c | 3.13E+00 | c | 3.31E+00 | 6.89E+05 | 6.78E+05 | E | 6.89E+05 |
| Chlorobenzene | 108-90-7 | 6.20E+01 | nc | 6.2E+01 | nc | 6.20E+01 | NA | 1.38E+05 | T | 1.38E+05 |
| Ethylbenzene | 100-41-4 | 1.10E+03 | nc | 1.1E+03 | nc | 1.10E+03 | NA | 4.34E+03 | T | 4.34E+03 |
| m&p-Xylene | 108-38-3 | 7.30E+02 | nc | NA | | 7.30E+02 | NA | 6.51E+05 | T | 6.51E+05 |
| Styrene | 100-42-5 | 1.06E+03 | nc | 1.04E+03 | nc | 1.06E+03 | 2.13E+05 | 2.13E+05 | E | 2.13E+05 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 3.31E-02 | c | 3.13E-02 | c | 3.31E-02 | NA | 2.06E+04 | T | 2.06E+04 |
| o-Xylene | 95-47-6 | 7.30E+02 | nc | 7.3E+03 | nc | 7.30E+02 | NA | 6.51E+05 | T | 6.51E+05 |
| p-Ethyltoluene | 622-96-8 | NA | | NA | | NA | NA | 1.25E+05 | T | 1.25E+05 |
| 1,3,5-Trimethylbenzene | 108-67-8 | 6.21E+00 | nc | 6.21E+00 | nc | 6.21E+00 | NA | 3.68E+05 | T | 3.68E+05 |
| 1,2,4-Trimethylbenzene | 95-63-6 | 6.21E+00 | nc | 6.21E+00 | nc | 6.21E+00 | NA | 1.80E+05 | T | 1.80E+05 |
| Benzylchloride | 100-44-7 | 4.00E-02 | nc | 3.7E-02 | c | 4.00E-02 | 5.20E+03 | 5.17E+03 | E | 5.20E+03 |
| m-Dichlorobenzene | 541-73-1 | 3.30E+00 | nc | 3.3E+00 | nc | 3.30E+00 | NA | 3.61E+04 | T | 3.61E+04 |
| p-Dichlorobenzene | 106-46-7 | 2.80E-01 | c | 2.85E-01 | c | 2.80E-01 | NA | 6.61E+05 | T | 6.61E+05 |
| o-Dichlorobenzene | 95-50-1 | 2.09E+02 | nc | 3.29E+01 | nc | 2.09E+02 | NA | 3.01E+05 | T | 3.01E+05 |
| 1,2,4-Trichlorobenzene | 120-82-1 | NA | | NA | | NA | NA | 3.71E+04 | T | 3.71E+04 |
| Hexachlorobutadiene | 87-68-3 | 8.73E-02 | c | 8.03E-02 | c | 8.73E-02 | 3.21E+04 | 3.20E+04 | E | 3.21E+04 |
| trans-1,2-Dichloroethene | 156-60-5 | 7.30E+01 | nc | 7.3E+01 | nc | 7.30E+01 | NA | 4.95E+04 | T | 4.95E+04 |
| o-Chlorotoluene | 95-49-8 | 7.30E+01 | nc | 7.3E+01 | nc | 7.30E+01 | NA | 3.88E+05 | T | 3.88E+05 |
| p-Chlorotoluene | 106-43-4 | NA | | NA | | NA | NA | 3.88E+05 | T | 3.88E+05 |
| 1,3,5-Trichlorobenzene | 108-70-3 | NA | | NA | | NA | NA | NA | | |
| 1,2,3-Trichlorobenzene | 87-61-6 | NA | | NA | | NA | NA | 5.00E+04 | T | 5.00E+04 |
| Methylnitrite | 624-91-9 | NA | | NA | | NA | NA | NA | | |
| Acetonitrile | 75-05-8 | 6.20E+01 | nc | 6.2E+01 | nc | 6.20E+01 | NA | 1.01E+05 | T | 1.01E+05 |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| | | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Compound | CAS # | Region 9 PRG ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Region 3 RBC ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Health-based Screening Level ($\mu g/m^3$) | ERPG ($\mu g/m^3$) | TEEL ($\mu g/m^3$) | Source (T or E) | Acute Toxicity Value ($\mu g/m^3$) |
| Acrylonitrile | 107-13-1 | 2.80E-02 | c | 2.6E-02 | c | 2.80E-02 | 2.20E+04 | 2.17E+04 | E | 2.20E+04 |
| Nitromethane | 75-52-5 | NA | | NA | | NA | NA | 1.50E+05 | T | 1.50E+05 |
| Benzonitrile | 100-47-0 | NA | | NA | | NA | NA | 1.50E+04 | T | 1.50E+04 |
| Nitrobenzene | 98-95-3 | 2.09E+00 | nc | 2.19E+00 | nc | 2.09E+00 | NA | 1.51E+04 | T | 1.51E+04 |
| Carbonyl Sulfide | 463-58-1 | NA | | NA | | NA | NA | 9.84E+03 | T | 9.84E+03 |
| Sulfur Dioxide | 7446-09-5 | NA | | NA | | NA | 7.80E+02 | 7.86E+02 | E | 7.80E+02 |
| Carbon Disulfide | 75-15-0 | 7.30E+02 | nc | 7.3E+02 | nc | 7.30E+02 | NA | 3.73E+04 | T | 3.73E+04 |
| Thiophene | 110-02-1 | NA | | NA | | NA | NA | NA | | |
| Dimethyldisulfide | 624-92-0 | NA | | NA | | NA | 4.00E+01 | 3.85E+01 | E | 4.00E+01 |
| 2-Methylthiophene | 554-14-3 | NA | | NA | | NA | NA | NA | | |
| 3-Methylthiophene | 616-44-4 | NA | | NA | | NA | NA | NA | | |
| Dimethyltrisulfide | 3658-80-8 | NA | | NA | | NA | NA | NA | | |
| Isothiocyanatomethane | 556-61-6 | NA | | NA | | NA | NA | NA | | |
| 2-Chlorothiophene | 96-43-5 | NA | | NA | | NA | NA | NA | | |
| 3-Chlorothiophene | 17249-80-8 | NA | | NA | | NA | NA | NA | | |
| 2-Thiophenecarboxaldehyde | 98-03-3 | NA | | NA | | NA | NA | NA | | |
| Naphthalene | 91-20-3 | 3.13E+00 | nc | 3.29E+00 | nc | 3.13E+00 | NA | 7.86E+04 | T | 7.86E+04 |
| Acetaldehyde | 75-07-0 | 8.70E-01 | c | 8.1E-01 | c | 8.70E-01 | 1.80E+04 | 1.80E+04 | E | 1.80E+04 |
| Acrolein | 107-02-8 | 2.10E-02 | nc | 2.1E-02 | nc | 2.10E-02 | 2.30E+02 | 2.29E+03 | E | 2.30E+02 |
| Acetone | 67-64-1 | 3.40E+02 | nc | 3.7E+02 | nc | 3.40E+02 | NA | 2.37E+06 | T | 2.37E+06 |
| Propanal | 123-38-6 | NA | | NA | | NA | NA | 7.50E+04 | T | 7.50E+04 |
| Furan | 110-00-9 | 3.70E+00 | nc | NA | | 3.70E+00 | NA | 1.67E+02 | T | 1.67E+02 |
| 2-Propanol | 67-63-0 | NA | | NA | | NA | NA | 9.84E+05 | T | 9.84E+05 |
| 2-Methylpropanal | 78-84-2 | NA | | NA | | NA | NA | NA | | |
| Methacrolein | 78-85-3 | NA | | NA | | NA | NA | NA | | |
| 2,3-Butanedione | 625-34-3 | NA | | NA | | NA | NA | NA | | |
| Methyl-Vinyl Ketone | 78-94-4 | NA | | NA | | NA | NA | 8.61E+01 | T | 8.61E+01 |
| MTBE | 1634-04-4 | 3.10E+03 | nc | 3.1E+03 | nc | 3.10E+03 | NA | 4.32E+05 | T | 4.32E+05 |
| Butanal | 123-72-8 | NA | | NA | | NA | NA | 7.38E+04 | T | 7.38E+04 |
| 2-Butanone | 78-93-3 | 1.00E+03 | nc | 1.0E+03 | nc | 1.00E+03 | NA | 8.85E+05 | T | 8.85E+05 |
| Tetrahydrofuran | 109-99-9 | 9.89E-01 | nc | 9.21E-01 | c | 9.89E-01 | NA | 7.38E+05 | T | 7.38E+05 |
| 2-Methyl-1-propanol | 78-83-1 | 1.10E+03 | nc | 1.1E+03 | nc | 1.10E+03 | NA | 4.55E+05 | T | 4.55E+05 |
| trans-2-Butenal | 123-73-9 | 3.54E-03 | c | 3.30E-03 | c | 3.54E-03 | NA | NA | | |
| Acetic Acid | 64-19-7 | NA | | NA | | NA | NA | 3.68E+04 | T | 3.68E+04 |
| 2-Pentanone | 107-87-9 | NA | | NA | | NA | NA | 8.80E+05 | T | 8.80E+05 |
| Pentanal | 110-62-3 | NA | | NA | | NA | NA | NA | | |
| 4-Methyl-2-pentanone | 108-10-1 | 8.30E+01 | nc | 7.3E+01 | nc | 8.30E+01 | NA | 3.07E+05 | T | 3.07E+05 |
| trans-2-Pentenal | 1567-87-0 | NA | | NA | | NA | NA | NA | | |
| Cyclopentanone | 120-92-3 | NA | | NA | | NA | NA | NA | | |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| | | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Compound | CAS # | Region 9 PRG ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Region 3 RBC ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Health-based Screening Level ($\mu g/m^3$) | ERPG ($\mu g/m^3$) | TEEL ($\mu g/m^3$) | Source (T or E) | Acute Toxicity Value ($\mu g/m^3$) |
| 2-Hexanone | 591-78-6 | NA | | 5.1E+00 | nc | 5.11E+00 | NA | 4.09E+04 | T | 4.09E+04 |
| Hexanal | 66-25-1 | NA | | NA | | NA | NA | NA | | |
| 3-Furaldehyde | 498-60-2 | NA | | NA | | NA | NA | NA | | |
| Butyl Acetate | 123-86-4 | NA | | NA | | NA | NA | NA | | |
| 2-Furaldehyde | 98-01-1 | 5.20E+01 | nc | 3.7E+01 | nc | 5.20E+01 | NA | 7.86E+03 | T | 7.86E+03 |
| trans-2-Hexenal | 6728-26-3 | NA | | NA | | NA | NA | NA | | |
| 1-Hexanol | 111-27-3 | NA | | NA | | NA | NA | 8.36E+03 | T | 8.36E+03 |
| 3-Heptanone | 106-35-4 | NA | | NA | | NA | NA | NA | | |
| 2-Heptanone | 110-43-0 | NA | | NA | | NA | NA | 1.70E+03 | T | 1.70E+03 |
| Heptanal | 66-25-1 | NA | | NA | | NA | NA | NA | | |
| trans-2-Heptenal | 18829-55-5 | NA | | NA | | NA | NA | NA | | |
| 5-Methyl-2-furaldehyde | 620-02-0 | NA | | NA | | NA | NA | NA | | |
| 6-Methyl-2-heptanone | 928-68-7 | NA | | NA | | NA | NA | NA | | |
| Benzaldehyde | 100-52-7 | 3.70E+02 | nc | 3.7E+02 | nc | 3.70E+02 | NA | 1.50E+04 | T | 1.50E+04 |
| 1-Heptanol | 111-70-6 | NA | | NA | | NA | NA | NA | | |
| 6-Methyl-5-hepten-2-one | 110-93-0 | NA | | NA | | NA | NA | NA | | |
| 2-Octanone | 111-13-7 | NA | | NA | | NA | NA | NA | | |
| Octanal | 124-13-0 | NA | | NA | | NA | NA | NA | | |
| Benzofuran | 271-89-6 | NA | | NA | | NA | NA | NA | | |
| trans-2-Octenal | 2548-87-0 | NA | | NA | | NA | NA | NA | | |
| Acetophenone | 98-86-2 | 2.10E-02 | nc | 2.1E-02 | nc | 2.10E-02 | NA | 3.00E+04 | T | 3.00E+04 |
| 2-Nonanone | 821-55-6 | NA | | NA | | NA | NA | NA | | |
| Nonanal | 124-19-6 | NA | | NA | | NA | NA | NA | | |
| trans-2-Nonenal | 18829-56-6 | NA | | NA | | NA | NA | NA | | |
| 2-Decanone | 693-54-9 | NA | | NA | | NA | NA | NA | | |
| Decanal | 112-31-2 | NA | | NA | | NA | NA | NA | | |
| N-Nitrosodimethylamine | 62-75-9 | 1.40E-04 | c | 1.2E-04 | c | 1.40E-04 | NA | 2.50E+03 | T | 2.50E+03 |
| Pyridine | 110-86-1 | 3.65E+00 | nc | 3.65E+00 | nc | 3.65E+00 | NA | 4.85E+04 | T | 4.85E+04 |
| 2-Picoline | 109-06-8 | NA | | NA | | NA | NA | NA | | |
| Methyl methanesulfonate | 66-27-3 | NA | | NA | | NA | NA | NA | | |
| N-Nitrosomethylethylamine | 10595-95-6 | 3.06E-04 | c | 2.85E-04 | c | 3.06E-04 | NA | NA | | |
| N-Nitrosodiethylamine | 55-18-5 | 4.47E-05 | c | 4.17E-05 | c | 4.47E-05 | NA | NA | | |
| Ethyl methanesulfonate | 62-50-0 | NA | | NA | | NA | NA | NA | | |
| Phenol | 108-95-2 | 2.19E+03 | nc | 2.19E+03 | nc | 2.19E+03 | 3.85E+05 | 3.85E+04 | E | 3.85E+05 |
| Aniline | 62-53-3 | NA | | 1.1E+00 | nc | 1.06E+00 | NA | 2.29E+04 | T | 2.29E+04 |
| bis(2-Chloroethyl)ether | 111-44-4 | 5.80E-03 | c | 5.7E-03 | c | 5.80E-03 | NA | 5.85E+04 | T | 5.85E+04 |
| Pentachloroethane | 76-01-7 | NA | | NA | | NA | NA | NA | | |
| 2-Chlorophenol | 95-57-8 | 1.80E+01 | nc | 1.8E+01 | nc | 1.80E+01 | NA | 5.25E+03 | T | 5.25E+03 |
| 1,3-Dichlorobenzene | 543-73-1 | NA | | NA | | NA | NA | NA | | |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| | | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Compound | CAS # | Region 9 PRG ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Region 3 RBC ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Health-based Screening Level ($\mu g/m^3$) | ERPG ($\mu g/m^3$) | TEEL ($\mu g/m^3$) | Source (T or E) | Acute Toxicity Value ($\mu g/m^3$) |
| 1,4-Dichlorobenzene | 106-46-7 | 2.80E-01 | c | 2.85E-01 | c | 2.80E-01 | NA | 6.61E+05 | T | 6.61E+05 |
| Benzyl alcohol | 100-51-6 | 1.10E+03 | nc | 1.1E+03 | nc | 1.10E+03 | NA | 5.53E+04 | T | 5.53E+04 |
| 2-Methylphenol | 95-48-7 | NA | | NA | | NA | NA | 6.63E+04 | T | 6.63E+04 |
| 1,2-Dichlorobenzene | 95-50-1 | 2.09E+02 | nc | 3.29E+01 | nc | 2.09E+02 | NA | 3.01E+05 | T | 3.01E+05 |
| bis(2-Chloroisopropyl)ether | 108-60-1 | 1.92E-01 | c | 1.79E-01 | c | 1.92E-01 | NA | 6.99E+04 | T | 6.99E+04 |
| o-Toluidine | 95-53-4 | 2.80E-02 | c | 2.6E-02 | c | 2.80E-02 | NA | 2.63E+04 | T | 2.63E+04 |
| 4-Methylphenol/3-Methylphenol | 1319-77-3 | NA | | NA | | NA | NA | 6.63E+04 | T | 6.63E+04 |
| N-Nitroso-di-n-propylamine | 621-64-7 | 9.61E-04 | c | 8.94E-04 | c | 9.61E-04 | NA | 5.32E+03 | T | 5.32E+03 |
| Acetophenone | 98-86-2 | 2.10E-02 | nc | 2.1E-02 | nc | 2.10E-02 | NA | 1.47E+05 | T | 1.47E+05 |
| N-Nitrosomorpholine | 59-89-2 | NA | | NA | | NA | NA | 3.00E+04 | T | 3.00E+04 |
| N-Nitrosopyrrolidine | 930-55-2 | 3.15E-03 | c | 3.0E-03 | c | 3.15E-03 | NA | NA | | |
| Hexachloroethane | 67-72-1 | 4.80E-01 | c | 4.47E-01 | c | 4.80E-01 | NA | 2.90E+04 | T | 2.90E+04 |
| Nitrobenzene | 98-95-3 | 2.09E+00 | nc | 2.19E+00 | nc | 2.09E+00 | NA | 1.51E+04 | T | 1.51E+04 |
| N-Nitrosopiperidine | 100-75-4 | NA | | NA | | NA | NA | NA | | |
| Isophorone | 78-59-1 | 7.08E+00 | c | 6.59E+00 | c | 7.08E+00 | NA | 2.83E+04 | T | 2.83E+04 |
| 2,4-Dimethylphenol | 105-67-9 | 7.30E+01 | nc | 7.3E+01 | nc | 7.30E+01 | NA | NA | | |
| 2-Nitrophenol | 88-75-5 | NA | | NA | | NA | NA | NA | | |
| bis(2-Chloroethoxy)methane | 111-91-1 | NA | | NA | | NA | NA | NA | | |
| Benzoic acid | 65-85-0 | 1.50E+04 | nc | 1.5E+04 | nc | 1.50E+04 | NA | 1.25E+04 | T | 1.25E+04 |
| 2,4-Dichlorophenol | 120-83-2 | 1.10E+01 | nc | 1.1E+01 | nc | 1.10E+01 | NA | 3.00E+04 | T | 3.00E+04 |
| 1,2,4-Trichlorobenzene | 120-82-1 | NA | | NA | | NA | NA | 3.71E+04 | T | 3.71E+04 |
| Naphthalene | 91-20-3 | 3.13E+00 | nc | 3.29E+00 | nc | 3.13E+00 | NA | 7.86E+04 | T | 7.86E+04 |
| p-Chloroaniline | 106-47-8 | 1.46E+01 | nc | 1.46E+01 | nc | 1.46E+01 | NA | 5.21E+03 | T | 5.21E+03 |
| 2,6-Dichlorophenol | 87-65-0 | NA | | NA | | NA | NA | 3.00E+04 | T | 3.00E+04 |
| Hexachloropropene | 1888-71-7 | NA | | NA | | NA | NA | NA | | |
| Hexachlorobutadiene | 87-68-3 | 8.73E-02 | c | 8.03E-02 | c | 8.73E-02 | 3.21E+04 | 3.20E+04 | E | 3.21E+04 |
| Dimethylphenethylamine | | NA | | NA | | NA | NA | NA | | |
| N-Nitroso-di-n-butylamine | 924-16-3 | 1.20E-03 | c | 1.12E-03 | c | 1.20E-03 | NA | NA | | |
| 4-Chloro-3-methylphenol | 35421-08-0 | NA | | NA | | NA | NA | NA | | |
| Safrole | 94-59-7 | NA | | NA | | NA | NA | NA | | |
| 2-Methylnaphthalene | 91-57-6 | NA | | NA | | NA | NA | 2.00E+04 | T | 2.00E+04 |
| 1,2,4,5-Tetrachlorobenzene | 95-94-3 | 1.10E+00 | nc | 1.10E+00 | nc | 1.10E+00 | NA | 3.00E+04 | T | 3.00E+04 |
| Hexachlorocyclopentadiene | 77-47-4 | 7.30E-02 | nc | 7.30E-02 | nc | 7.30E-02 | NA | 2.23E+02 | T | 2.23E+02 |
| 2,4,6-Trichlorophenol | 88-06-2 | 6.20E-01 | c | 6.3E-01 | c | 6.20E-01 | NA | 3.00E+04 | T | 3.00E+04 |
| 2,4,5-Trichlorophenol | 95-95-4 | 3.70E+02 | nc | 3.7E+02 | nc | 3.70E+02 | NA | 3.00E+04 | T | 3.00E+04 |
| Isosafrole | 120-58-1 | NA | | NA | | NA | NA | NA | | |
| 2-Chloronaphthalene | 91-58-7 | 2.90E+02 | nc | 2.9E+02 | nc | 2.90E+02 | NA | 6.00E+02 | T | 6.00E+02 |
| 2-Nitroaniline | 88-74-4 | 2.10E-01 | nc | 2.1E-01 | nc | 2.10E-01 | NA | NA | | |
| 1,4-Naphthoquinone | 130-15-4 | NA | | NA | | NA | NA | 2.50E+02 | T | 2.50E+02 |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| Compound | CAS # | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Region 9 PRG ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Region 3 RBC ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Health-based Screening Level ($\mu g/m^3$) | ERPG ($\mu g/m^3$) | TEEL ($\mu g/m^3$) | Source (T or E) | Acute Toxicity Value ($\mu g/m^3$) |
| Dimethylphthalate | 131-11-3 | 3.65E+04 | nc | 3.65E+04 | nc | 3.65E+04 | NA | 1.50E+04 | T | 1.50E+04 |
| 1,3-Dinitrobenzene | 99-65-0 | 3.70E-01 | nc | 3.7E-01 | nc | 3.70E-01 | NA | 3.00E+03 | T | 3.00E+03 |
| 2,6-Dinitrotoluene | 606-20-2 | 3.70E+00 | nc | 3.7E+00 | nc | 3.70E+00 | NA | 6.00E+02 | T | 6.00E+02 |
| Acenaphthylene | 208-96-8 | NA | | NA | | NA | NA | 2.00E+02 | T | 2.00E+02 |
| 3-Nitroaniline | 99-09-2 | NA | | NA | | NA | NA | NA | | |
| 4-Nitrophenol | 100-02-7 | 2.90E+01 | nc | 2.9E+01 | nc | 2.90E+01 | NA | 3.00E+04 | T | 3.00E+04 |
| 2,4-Dinitrophenol | 51-28-5 | 7.30E+00 | nc | 7.3E+00 | nc | 7.30E+00 | NA | 7.50E+03 | T | 7.50E+03 |
| Acenaphthene | 83-32-9 | 2.20E+02 | nc | 2.2E+02 | nc | 2.20E+02 | NA | 1.25E+03 | T | 1.25E+03 |
| 2,4-Dinitrotoluene | 121-14-2 | 7.30E+00 | nc | 7.3E+00 | nc | 7.30E+00 | NA | 6.00E+02 | T | 6.00E+02 |
| Dibenzofuran | 132-64-9 | 1.46E+01 | nc | 1.46E+01 | nc | 1.46E+01 | NA | 1.50E+00 | T | 1.50E+00 |
| Pentachlorobenzene | 608-93-5 | 2.92E+00 | nc | 2.92E+00 | nc | 2.92E+00 | NA | 3.00E+04 | T | 3.00E+04 |
| 1-Naphthylamine | 134-32-7 | NA | | NA | | NA | NA | 3.50E+04 | T | 3.50E+04 |
| 2-Naphthylamine | 91-59-8 | NA | | NA | | NA | NA | 7.50E+03 | T | 7.50E+03 |
| 2,3,4,6-Tetrachlorophenol | 58-90-2 | 1.10E+02 | nc | 1.1E+02 | nc | 1.10E+02 | NA | NA | | |
| Diethylphthalate | 84-66-2 | 2.92E+03 | nc | 2.92E+03 | nc | 2.92E+03 | NA | 1.50E+04 | T | 1.50E+04 |
| 4-Chlorophenylphenyl ether | 7005-72-3 | NA | | NA | | NA | NA | NA | | |
| Fluorene | 86-73-7 | 1.46E+02 | nc | 1.46E+02 | nc | 1.46E+02 | NA | 7.50E+04 | T | 7.50E+04 |
| 5-Nitro-o-toluidine | 99-55-8 | 2.00E-01 | c | 1.9E-01 | c | 2.00E-01 | NA | NA | | |
| 4-Nitroaniline | 100-01-6 | NA | | NA | | NA | NA | 9.00E+03 | T | 9.00E+03 |
| 4,6-Dinitro-2-methylphenol | 534-52-1 | NA | | 3.7E-01 | nc | 3.65E-01 | NA | 5.00E+02 | T | 5.00E+02 |
| Diphenylamine/N-NitrosoDPA | 62-75-9 | NA | | NA | | NA | NA | 2.50E+03 | T | 2.50E+03 |
| sym-Trinitrobenzene | 99-35-4 | 1.10E+02 | nc | 1.10E+02 | nc | 1.10E+02 | NA | 3.00E+04 | T | 3.00E+04 |
| Diallate | 2303-16-4 | 1.10E-01 | c | NA | | 1.10E-01 | NA | NA | | |
| Phenacetin | 62-44-2 | NA | | NA | | NA | NA | 3.00E+04 | T | 3.00E+04 |
| 4-Bromophenylphenyl ether | 101-55-3 | NA | | NA | | NA | NA | NA | | |
| Hexachlorobenzene | 118-74-1 | 4.18E-03 | c | 3.91E-03 | c | 4.18E-03 | NA | 7.50E+01 | T | 7.50E+01 |
| 4-Aminobiphenyl | 92-67-1 | NA | | NA | | NA | NA | 1.50E+03 | T | 1.50E+03 |
| Pronamide | 23950-58-5 | 2.74E+02 | nc | NA | | 2.74E+02 | NA | NA | | |
| Pentachlorophenol | 87-86-5 | 5.60E-02 | c | 5.22E-02 | c | 5.60E-02 | NA | 1.50E+03 | T | 1.50E+03 |
| Pentachloronitrobenzene | 82-68-8 | 2.59E-02 | c | 2.41E-02 | c | 2.59E-02 | NA | 1.50E+03 | T | 1.50E+03 |
| Phenanthrene | 85-01-8 | NA | | NA | | NA | NA | 2.00E+03 | T | 2.00E+03 |
| Anthracene | 120-12-7 | 1.10E+03 | nc | 1.1E+03 | nc | 1.10E+03 | NA | 6.00E+03 | T | 6.00E+03 |
| Carbazole | 86-74-8 | 3.36E-01 | c | 3.13E-01 | c | 3.36E-01 | NA | NA | | |
| Di-n-butylphthalate | 84-74-2 | 3.65E+02 | nc | 3.65E+02 | nc | 3.65E+02 | NA | 1.50E+04 | T | 1.50E+04 |
| 4-Nitroquinoline-1-oxide | 56-57-5 | NA | | NA | | NA | NA | NA | | |
| Methapyrilene | 91-80-5 | NA | | NA | | NA | NA | NA | | |
| Fluoranthene | 206-44-0 | 1.50E+02 | nc | 1.5E+02 | nc | 1.50E+02 | NA | 3.00E+01 | T | 3.00E+01 |
| Benzidine | 92-87-5 | 2.90E-05 | c | NA | | 2.90E-05 | NA | 5.00E+02 | T | 5.00E+02 |
| Pyrene | 129-00-0 | NA | | NA | | NA | NA | 1.50E+04 | T | 1.50E+04 |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| | | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Compound | CAS # | Region 9 PRG ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Region 3 RBC ($\mu g/m^3$) | Toxicity Endpoint (c or nc) | Health-based Screening Level ($\mu g/m^3$) | ERPG ($\mu g/m^3$) | TEEL ($\mu g/m^3$) | Source (T or E) | Acute Toxicity Value ($\mu g/m^3$) |
| p-Dimethylaminoazobenzene | 60-11-7 | NA | | NA | | NA | NA | 7.50E+04 | T | 7.50E+04 |
| Chlorobenzilate | 510-15-6 | 2.49E-02 | c | 2.32E-02 | c | 2.49E-02 | NA | 2.50E+02 | T | 2.50E+02 |
| Kepone | 143-50-0 | 3.74E-04 | c | NA | | 3.74E-04 | NA | 1.00E+02 | T | 1.00E+02 |
| Butylbenzylphthalate | 85-68-7 | 7.30E+02 | nc | 7.30E+02 | nc | 7.30E+02 | NA | 5.00E+05 | T | 5.00E+05 |
| 3,3'-Dimethylbenzidine | 119-93-7 | 7.30E-04 | c | 6.8E-04 | c | 7.30E-04 | NA | 3.00E+00 | T | 3.00E+00 |
| 2-Acetylaminofluorene | 53-96-3 | NA | | NA | | NA | NA | 2.50E+03 | T | 2.50E+03 |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | 4.80E-01 | c | 4.47E-01 | c | 4.80E-01 | NA | 1.00E+04 | T | 1.00E+04 |
| 3,3'-Dichlorobenzidine | 91-94-1 | 1.50E-02 | c | 1.4E-02 | c | 1.50E-02 | NA | 6.21E+03 | T | 6.21E+03 |
| Benz(a)anthracene | 56-55-3 | 2.20E-02 | c | 8.6E-03 | c | 2.20E-02 | NA | 6.00E+02 | T | 6.00E+02 |
| Chrysene | 218-01-9 | 2.17E+00 | c | 8.58E-01 | c | 2.17E+00 | NA | 2.00E+02 | T | 2.00E+02 |
| Di-n-octylphthalate | 117-84-0 | 7.30E+01 | nc | 7.30E+01 | nc | 7.30E+01 | NA | 1.50E+05 | T | 1.50E+05 |
| 7,12-Dimethylbenz(a)anthracene | 57-97-6 | NA | | NA | | NA | NA | NA | | |
| Benzo(b)fluoranthene | 205-99-2 | 2.20E-02 | c | 8.6E-03 | c | 2.20E-02 | NA | NA | | |
| Benzo(k)fluoranthene | 207-08-9 | 2.20E-01 | c | 8.6E-02 | c | 2.20E-01 | NA | NA | | |
| Benz(a)pyrene | 50-32-8 | 2.20E-03 | c | 2.0E-03 | c | 2.20E-03 | NA | 7.50E+03 | T | 7.50E+03 |
| 3-Methylcholanthrene | 56-49-5 | NA | | NA | | NA | NA | 1.50E+03 | T | 1.50E+03 |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | 2.17E-02 | c | 8.58E-03 | c | 2.17E-02 | NA | NA | | |
| Dibenz(a,h)anthracene | 53-70-3 | 2.17E-03 | c | 8.58E-04 | c | 2.17E-03 | NA | 3.00E+04 | T | 3.00E+04 |
| Benzo(g,h,i)perylene | 191-24-2 | NA | | NA | | NA | NA | 3.00E+04 | T | 3.00E+04 |

Footnotes:
PRG: Preliminary Remediation Goals
c: Cancer
nc:non-cancer
RBC: Risk-Based Concentration
HBSL: Health-based Screening Level
(E) ERPG: Emergency Response Planning Guidelines
(T) TEEL: Temporary Emergency Exposure Limits
ATV: Acute Toxicity Value
NA: Not available

# APPENDIX D

# RISK EVALUATION DATA

**Table D-1: Comparison of Air Concentrations With Health-Based Values: Metals, Particulates and Miscellaneous Compounds**

| | Red Parachute Signal Flare | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Compound | $C_{chronic}$ (µg/m$^3$) | Health-Based Screening Level (µg/m$^3$) | $C_{chronic}$/ HBSL | > 1? | $C_{acute}$ (µg/m$^3$) | Acute Toxicity Value (µg/m$^3$) | $C_{acute}$/ ATV | > 1? |
| TSP | 1.78E-02 | 5.00E+01 | 3.55E-04 | no | NA | NA | | na |
| $PM_{10}$ | 1.68E-02 | 5.00E+01 | 3.36E-04 | no | NA | NA | | na |
| HCl (a) | NA | 2.08E+01 | | na | NA | 7.14E+03 | | na |
| $Cl_2$ (a) | 1.04E-05 | 2.09E-01 | 4.97E-05 | no | 1.82E-02 | 2.89E+03 | 6.28E-06 | no |
| Dioxin TEQ (b) | 3.25E-14 | 4.48E-08 | 7.25E-07 | no | 5.31E-10 | 3.50E+00 | 1.52E-10 | no |
| Carbon Monoxide (CO) | 1.42E-03 | 1.57E+02 | 9.03E-06 | no | 2.49E+00 | 2.30E+05 | 1.08E-05 | no |
| Nitrogen Oxide (NOx) | 4.17E-04 | 1.00E+02 | 4.17E-06 | no | 2.92E+00 | 2.70E+05 | 1.08E-05 | no |
| HCl (a) | 1.42E-05 | 2.08E+01 | 6.80E-07 | no | 9.93E-02 | 7.14E+03 | 1.39E-05 | no |
| Carbon Dioxide ($CO_2$) | 1.94E-02 | NV | | na | 1.36E+02 | 5.40E+07 | 2.52E-06 | no |
| Sulfur Dioxide ($SO_2$) | 9.84E-06 | 8.00E+01 | 1.23E-07 | no | 1.72E-02 | 7.89E+02 | 2.18E-05 | no |
| Aluminum | 2.32E-05 | 3.65E+00 | 6.36E-06 | no | 1.63E-01 | 3.00E+04 | 5.42E-06 | no |
| Antimony | 6.07E-08 | 1.46E+00 | 4.16E-08 | no | 4.26E-04 | 1.50E+03 | 2.84E-07 | no |
| Arsenic | NA | 4.47E-04 | | na | NA | 3.00E+01 | | na |
| Barium | 4.91E-05 | 5.21E-01 | 9.43E-05 | no | 3.44E-01 | 1.50E+03 | 2.30E-04 | no |
| Beryllium | NA | 8.00E-04 | | na | NA | 5.00E+00 | | na |
| Cadmium | 3.85E-08 | 1.07E-03 | 3.61E-05 | no | 6.30E-04 | 3.00E+01 | 2.10E-05 | no |
| Chromium | 2.00E-07 | 1.53E-04 | 1.31E-03 | no | 3.27E-03 | 1.50E+03 | 2.18E-06 | no |
| Cobalt | 6.10E-08 | 2.20E+02 | 2.77E-10 | no | 4.27E-04 | 6.00E+01 | 7.12E-06 | no |
| Copper | 9.40E-07 | 1.46E+02 | 6.44E-09 | no | 6.59E-03 | 3.00E+03 | 2.20E-06 | no |
| Lead | 3.44E-07 | 1.50E+00 | 2.29E-07 | no | 2.41E-03 | 1.50E+02 | 1.61E-05 | no |
| Magnesium | 2.12E-03 | NV | | na | 1.49E+01 | 3.00E+04 | 4.95E-04 | no |
| Manganese | 3.23E-06 | 5.11E-02 | 6.32E-05 | no | 2.26E-02 | 3.00E+03 | 7.55E-06 | no |
| Nickel | 9.35E-08 | 7.30E+01 | 1.28E-09 | no | 6.55E-04 | 3.00E+03 | 2.18E-07 | no |
| Phosphorus | 1.60E-06 | NV | | na | 1.12E-02 | 3.00E+02 | 3.73E-05 | no |
| Selenium | NA | 1.83E+01 | | na | NA | 6.00E+02 | | na |
| Silver | NA | 1.83E+01 | | na | NA | 3.00E+02 | | na |
| Thallium | NA | 2.56E-01 | | na | NA | 3.00E+02 | | na |
| Zinc | 8.93E-07 | 1.10E+03 | 8.15E-10 | no | 6.26E-03 | 3.00E+04 | 2.09E-07 | no |
| Mercury | 1.27E-14 | 3.13E-01 | 4.07E-14 | no | 8.92E-05 | 1.00E+02 | 8.92E-07 | no |

Footnote:
(a) HCl/$Cl_2$ levels were too low to be reliably measured.
(b) Presence questionable - reported at similar levels in samples and blanks.
NA = Not applicable because compound was not detected.
na = Not available because health-based screening value is not available or not applicable if compound was not detected.
NV = No value
$C_{chronic}$ = Chronic time-averaged concentration ; HBSL = Chronic health-based screening level
>1? = Is the ratio greater than one?
$C_{acute}$ = Acute concentration; ATV = Acute toxicity value

## Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

| | Red Parachute Signal Flare | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Compound (a) | $C_{chronic}$ (µg/m$^3$) | Health-Based Screening Level (µg/m$^3$) | $C_{chronic}$/ HBSL | > 1? | $C_{acute}$ (µg/m$^3$) | Acute Toxicity Value (µg/m$^3$) | $C_{acute}$/ ATV | > 1? |
| **Total Nonmethane Hydrocarbons (TNMHC)** | | | | | | | | |
| TNMHC | 4.55E-05 | NV | | na | NA | NA | | na |
| **Volatile Organic Compounds (VOCs)** | | | | | | | | |
| Ethane | 1.68E-06 | NV | | na | NA | NA | | na |
| Ethylene | 1.76E-05 | NV | | na | 1.23E-01 | 4.60E+05 | 2.68E-07 | no |
| Acetylene | 1.22E-05 | NV | | na | NA | NA | | na |
| Propane | 3.78E-07 | NV | | na | 2.65E-03 | 3.78E+06 | 7.01E-10 | no |
| Propene | 3.86E-06 | NV | | na | NA | NA | | na |
| i-Butane | 7.56E-08 | NV | | na | 5.30E-04 | 5.71E+06 | 9.28E-11 | no |
| i-Butene | 2.12E-07 | NV | | na | NA | NA | | na |
| 1-Butene | 7.56E-07 | NV | | na | NA | NA | | na |
| **1,3-Butadiene** | 4.15E-07 | 3.74E-03 | 1.11E-04 | no | 1.70E-03 | 2.20E+04 | 7.71E-08 | no |
| n-Butane | 1.06E-07 | NV | | na | 7.42E-04 | 5.71E+06 | 1.30E-10 | no |
| trans-2-Butene | 7.56E-07 | NV | | na | NA | NA | | na |
| 2,2-Dimethylpropane | NA | NV | | na | NA | NA | | na |
| cis-2-Butene | 1.36E-07 | NV | | na | NA | NA | | na |
| 3-Methyl-1-butene | NA | NV | | na | NA | NA | | na |
| i-Pentane | NA | NV | | na | NA | 1.80E+06 | | na |
| 1-Pentene | 1.51E-07 | NV | | na | NA | NA | | na |
| 2-Methyl-1-butene | 3.02E-08 | NV | | na | NA | NA | | na |
| n-Pentane | 1.81E-07 | NV | | na | 1.27E-03 | 1.80E+06 | 7.07E-10 | no |
| Isoprene | 1.51E-07 | NV | | na | NA | NA | | na |
| trans-2-Pentene | 3.02E-08 | NV | | na | NA | NA | | na |
| cis-2-Pentene | 3.02E-08 | NV | | na | NA | NA | | na |
| 2-Methyl-2-butene | 6.05E-08 | NV | | na | NA | NA | | na |
| 2,2-Dimethylbutane | 6.05E-08 | NV | | na | 4.24E-04 | 1.80E+06 | 2.36E-10 | no |
| Cyclopentene | 4.54E-08 | NV | | na | NA | NA | | na |
| 4-Methyl-1-pentene | NA | NV | | na | NA | NA | | na |
| Cyclopentane | 1.51E-08 | NV | | na | NA | NA | | na |

## Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

| | Red Parachute Signal Flare | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Compound (a) | $C_{chronic}$ (µg/m$^3$) | Health-Based Screening Level (µg/m$^3$) | $C_{chronic}$/ HBSL | > 1? | $C_{acute}$ (µg/m$^3$) | Acute Toxicity Value (µg/m$^3$) | $C_{acute}$/ ATV | > 1? |
| 2,3-Dimethylbutane | 1.51E-08 | NV | | na | NA | NA | | na |
| cis-4-Methyl-2-pentene | NA | NV | | na | NA | NA | | na |
| 2-Methylpentane | 3.02E-08 | NV | | na | 2.12E-04 | 1.80E+06 | 1.18E-10 | no |
| 3-Methylpentane | NA | NV | | na | NA | NA | | na |
| 2-Methyl-1-pentene | NA | NV | | na | NA | NA | | na |
| 1-Hexene | 1.21E-07 | NV | | na | 8.48E-04 | 1.03E+05 | 8.23E-09 | no |
| n-Hexane | 3.02E-08 | 2.10E+02 | 1.44E-10 | no | 2.12E-04 | 5.28E+05 | 4.01E-10 | no |
| trans-2-Hexene | NA | NV | | na | NA | NA | | na |
| 2-Methyl-2-pentene | NA | NV | | na | NA | NA | | na |
| cis-2-Hexene | NA | NV | | na | NA | NA | | na |
| Methylcyclopentane | 4.54E-08 | NV | | na | NA | NA | | na |
| 2,4-Dimethylpentane | NA | NV | | na | NA | NA | | na |
| Benzene | 7.52E-07 | 2.50E-01 | 3.01E-06 | no | 3.07E-03 | 1.56E+05 | 1.97E-08 | no |
| Cyclohexane | 1.21E-07 | NV | | na | 8.48E-04 | 3.10E+06 | 2.74E-10 | no |
| 2-Methylhexane | NA | NV | | na | NA | NA | | na |
| 2,3-Dimethylpentane | NA | NV | | na | NA | NA | | na |
| 3-Methylhexane | NA | NV | | na | NA | NA | | na |
| 2,2,4-Trimethylpentane | NA | NV | | na | NA | 3.50E+05 | | na |
| n-Heptane | 7.56E-08 | NV | | na | 5.30E-04 | 1.80E+06 | 2.94E-10 | no |
| 2,4,4-Trimethyl-1-pentene | NA | NV | | na | NA | NA | | na |
| Methylcyclohexane | NA | 3.10E+03 | | na | NA | 4.81E+06 | | na |
| 2,4,4-Trimethyl-2-pentene | NA | NV | | na | NA | NA | | na |
| 2,5-Dimethylhexane | 1.51E-08 | NV | | na | NA | NA | | na |
| 2,4-Dimethylhexane | NA | NV | | na | NA | NA | | na |
| 2,3,4-Trimethylpentane | 1.64E-23 | NV | | na | NA | NA | | na |
| Toluene | 3.63E-07 | 4.02E+02 | 9.04E-10 | no | 6.36E-04 | 1.88E+05 | 3.39E-09 | no |
| 2,3-Dimethylhexane | NA | NV | | na | NA | NA | | na |
| 2-Methylheptane | 3.02E-08 | NV | | na | NA | NA | | na |
| 3-Ethylhexane | 3.02E-08 | NV | | na | NA | NA | | na |

## Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

| | Red Parachute Signal Flare | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Compound (a)** | **$C_{chronic}$ (µg/m$^3$)** | **Health-Based Screening Level (µg/m$^3$)** | **$C_{chronic}$/ HBSL** | **> 1?** | **$C_{acute}$ (µg/m$^3$)** | **Acute Toxicity Value (µg/m$^3$)** | **$C_{acute}$/ ATV** | **> 1?** |
| 2,2-Dimethylheptane | NA | NV | | na | NA | NA | | na |
| 2,2,4-Trimethylhexane | NA | NV | | na | NA | NA | | na |
| n-Octane | 3.02E-08 | NV | | na | NA | NA | | na |
| Ethylcyclohexane | NA | NV | | na | NA | NA | | na |
| Ethylbenzene | NA | 1.10E+03 | | na | NA | 5.43E+05 | | na |
| m-Xylene & p-Xylene | NA | NV | | na | NA | 6.51E+05 | | na |
| Styrene | 1.36E-07 | 1.10E+03 | 1.24E-10 | no | 2.38E-04 | 2.13E+05 | 1.12E-09 | no |
| o-Xylene | NA | 7.30E+03 | | na | NA | 6.51E+05 | | na |
| n-Nonane | 2.27E-07 | 4.02E+02 | 5.65E-10 | no | 1.59E-03 | 1.05E+06 | 1.52E-09 | no |
| i-Propylbenzene | NA | 4.00E+02 | | na | NA | NA | | na |
| n-Propylbenzene | 6.05E-08 | 3.65E+01 | 1.66E-09 | no | NA | NA | | na |
| p-Ethyltoluene | 1.51E-07 | NV | | na | 1.06E-03 | 1.25E+05 | 8.48E-09 | no |
| m-Ethyltoluene | 9.07E-08 | NV | | na | NA | NA | | na |
| 1,3,5-Trimethylbenzene | 7.56E-08 | 6.20E+00 | 1.22E-08 | no | 5.30E-04 | 3.68E+05 | 1.44E-09 | no |
| o-Ethyltoluene | 1.21E-07 | NV | | na | 8.48E-04 | 7.50E+02 | 1.13E-06 | no |
| 1,2,4-Trimethylbenzene & sec-Butylbenzene | 1.81E-07 | 6.21E+00 | 2.92E-08 | no | 1.27E-03 | 1.80E+05 | 7.07E-09 | no |
| n-Decane | NA | NV | | na | NA | 4.37E+03 | | na |
| alpha-Pinene | NA | NV | | na | NA | 4.00E+04 | | na |
| beta-Pinene | NA | NV | | na | NA | NA | | na |
| delta 3-Carene | NA | NV | | na | NA | NA | | na |
| d-Limonene | NA | NV | | na | NA | 1.95E+06 | | na |
| MTBE | NA | 3.10E+03 | | na | NA | 4.32E+05 | | na |
| Dichlorodifluoromethane | NA | 2.10E+02 | | na | NA | 1.48E+07 | | na |
| Methylchloride | NA | NV | | na | NA | NA | | na |
| Dichlorotetrafluoroethane | NA | NV | | na | NA | NA | | na |
| Chloroethene | NA | 2.20E-02 | | na | NA | 1.28E+04 | | na |
| **1,3-Butadiene** | 4.22E-07 | 3.74E-03 | 1.13E-04 | no | 1.72E-03 | 2.20E+04 | 7.84E-08 | no |
| Methylbromide | NA | 5.20E+00 | | na | NA | 5.82E+04 | | na |

## Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

| | Red Parachute Signal Flare | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Compound (a)** | **$C_{chronic}$ (µg/m$^3$)** | **Health-Based Screening Level (µg/m$^3$)** | **$C_{chronic}$/ HBSL** | **> 1?** | **$C_{acute}$ (µg/m$^3$)** | **Acute Toxicity Value (µg/m$^3$)** | **$C_{acute}$/ ATV** | **> 1?** |
| Ethylchloride | 1.81E-08 | 2.30E+00 | 7.88E-09 | no | 2.96E-04 | 7.92E+06 | 3.74E-11 | no |
| Trichloromonofluoromethane | NA | 7.30E+02 | | na | NA | 2.81E+06 | | na |
| Vinylidenechloride | NA | NV | | na | NA | 7.92E+04 | | na |
| Methylenechloride | NA | 4.10E+00 | | na | NA | 6.96E+05 | | na |
| Allylchloride | NA | 1.00E+00 | | na | NA | 9.39E+03 | | na |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | NA | 3.13E+04 | | na | NA | 9.58E+06 | | na |
| 1,1-Dichloroethane | NA | 5.21E+02 | | na | NA | 1.21E+06 | | na |
| 1,2-Dichloroethene | NA | 3.29E+01 | | na | NA | 2.38E+06 | | na |
| Chloroform | NA | 8.40E-02 | | na | NA | 9.76E+03 | | na |
| 1,2-Dichloroethane | NA | 7.39E-02 | | na | NA | 8.08E+03 | | na |
| Methylchloroform | NA | 1.00E+03 | | na | NA | 1.91E+06 | | na |
| **Benzene** | 7.65E-07 | 2.50E-01 | 3.06E-06 | no | 1.25E-02 | 1.60E+05 | 7.84E-08 | no |
| Carbontetrachloride | NA | 1.04E+03 | | na | NA | 1.28E+05 | | na |
| 1,2-Dichloropropane | NA | 9.89E-02 | | na | NA | 5.08E+05 | | na |
| Trichloroethylene | NA | 1.12E+00 | | na | NA | 5.37E+05 | | na |
| cis 1,3-Dichloro-1-propene | NA | NV | | na | NA | 1.14E+04 | | na |
| trans 1,3-Dichloro-1-propene | NA | NV | | na | NA | NA | | na |
| 1,1,2-Trichloroethane | NA | 1.20E-01 | | na | NA | 1.64E+05 | | na |
| **Toluene** | 3.69E-07 | 4.02E+02 | 9.19E-10 | no | 6.47E-04 | 1.88E+05 | 3.45E-09 | no |
| 1,2-Dibromoethane | NA | 8.73E-03 | | na | NA | 1.54E+05 | | na |
| Perchloroethylene | NA | 3.31E+00 | | na | NA | 6.89E+05 | | na |
| Chlorobenzene | NA | 6.20E+01 | | na | NA | 1.38E+05 | | na |
| **Ethylbenzene** | NA | 1.10E+03 | | na | NA | 4.34E+03 | | na |
| **m&p-Xylene** | NA | 7.30E+02 | | na | NA | 6.51E+05 | | na |
| **Styrene** | 1.38E-07 | 1.06E+03 | 1.31E-10 | no | 2.43E-04 | 2.13E+05 | 1.14E-09 | no |
| 1,1,2,2-Tetrachloroethane | NA | 3.31E-02 | | na | NA | 2.06E+04 | | na |
| **o-Xylene** | NA | 7.30E+02 | | na | NA | 6.51E+05 | | na |
| **p-Ethyltoluene** | 1.54E-07 | NV | | na | 1.08E-03 | 1.25E+05 | 8.62E-09 | no |
| **1,3,5-Trimethylbenzene** | 9.23E-08 | 6.21E+00 | 1.49E-08 | no | 6.47E-04 | 3.68E+05 | 1.76E-09 | no |

## Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

| | Red Parachute Signal Flare | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Compound (a)** | **$C_{chronic}$ (µg/m$^3$)** | **Health-Based Screening Level (µg/m$^3$)** | **$C_{chronic}$/ HBSL** | **> 1?** | **$C_{acute}$ (µg/m$^3$)** | **Acute Toxicity Value (µg/m$^3$)** | **$C_{acute}$/ ATV** | **> 1?** |
| **1,2,4-Trimethylbenzene** | 1.85E-07 | 6.21E+00 | 2.97E-08 | no | 1.29E-03 | 1.80E+05 | 7.19E-09 | no |
| Benzylchloride | NA | 4.00E-02 | | na | NA | 5.20E+03 | | na |
| m-Dichlorobenzene | NA | 3.30E+00 | | na | NA | 3.61E+04 | | na |
| p-Dichlorobenzene | NA | 2.80E-01 | | na | NA | 6.61E+05 | | na |
| o-Dichlorobenzene | NA | 2.09E+02 | | na | NA | 3.01E+05 | | na |
| 1,2,4-Trichlorobenzene | NA | NV | | na | NA | 3.71E+04 | | na |
| Hexachlorobutadiene | NA | 8.73E-02 | | na | NA | 3.21E+04 | | na |
| trans-1,2-Dichloroethene | NA | 7.30E+01 | | na | NA | 4.95E+04 | | na |
| o-Chlorotoluene | NA | 7.30E+01 | | na | NA | 3.88E+05 | | na |
| p-Chlorotoluene | NA | NV | | na | NA | 3.88E+05 | | na |
| 1,3,5-Trichlorobenzene | NA | NV | | na | NA | NA | | na |
| 1,2,3-Trichlorobenzene | NA | NV | | na | NA | 5.00E+04 | | na |
| Methylnitrite | 3.15E-08 | NV | | na | NA | NA | | na |
| Acetonitrile | 1.51E-07 | 6.20E+01 | 2.43E-09 | no | 1.05E-03 | 1.01E+05 | 1.05E-08 | no |
| Acrylonitrile | 4.94E-08 | 2.80E-02 | 1.77E-06 | no | 2.02E-04 | 2.20E+04 | 9.18E-09 | no |
| Nitromethane | 7.49E-08 | NV | | na | 5.25E-04 | 1.50E+05 | 3.50E-09 | no |
| Benzonitrile | 6.50E-08 | NV | | na | 4.55E-04 | 1.50E+04 | 3.04E-08 | no |
| Nitrobenzene | NA | 2.09E+00 | | na | NA | 1.51E+04 | | na |
| Carbonyl Sulfide | 6.22E-08 | NV | | na | 4.36E-04 | 9.84E+03 | 4.43E-08 | no |
| Sulfur Dioxide | NA | NV | | na | NA | 7.80E+02 | | na |
| Carbon Disulfide | 1.86E-06 | 7.30E+02 | 2.55E-09 | no | 1.31E-02 | 3.73E+04 | 3.50E-07 | no |
| Thiophene | 7.81E-08 | NV | | na | NA | NA | | na |
| Dimethyldisulfide | NA | NV | | na | NA | 4.00E+01 | | na |
| 2-Methylthiophene | NA | NV | | na | NA | NA | | na |
| 3-Methylthiophene | NA | NV | | na | NA | NA | | na |
| Dimethyltrisulfide | NA | NV | | na | NA | NA | | na |
| Isothiocyanatomethane | NA | NV | | na | NA | NA | | na |
| 2-Chlorothiophene | NA | NV | | na | NA | NA | | na |
| 3-Chlorothiophene | NA | NV | | na | NA | NA | | na |

## Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

| | Red Parachute Signal Flare | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Compound (a)** | **$C_{chronic}$ (µg/m$^3$)** | **Health-Based Screening Level (µg/m$^3$)** | **$C_{chronic}$/ HBSL** | **> 1?** | **$C_{acute}$ (µg/m$^3$)** | **Acute Toxicity Value (µg/m$^3$)** | **$C_{acute}$/ ATV** | **> 1?** |
| 2-Thiophenecarboxaldehyde | NA | NV | | na | NA | NA | | na |
| Naphthalene | 9.90E-08 | 3.13E+00 | 3.17E-08 | no | 6.94E-04 | 7.86E+04 | 8.83E-09 | no |
| Acetaldehyde | 8.24E-08 | 8.70E-01 | 9.47E-08 | no | 3.37E-04 | 1.80E+04 | 1.87E-08 | no |
| Acrolein | 8.01E-08 | 2.10E-02 | 3.82E-06 | no | 1.40E-04 | 2.30E+02 | 6.10E-07 | no |
| Acetone | NA | 3.40E+02 | | na | NA | 2.37E+06 | | na |
| Propanal | 1.82E-07 | NV | | na | 1.27E-03 | 7.50E+04 | 1.70E-08 | no |
| Furan | 7.99E-08 | 3.70E+00 | 2.16E-08 | no | 5.60E-04 | 1.67E+02 | 3.36E-06 | no |
| 2-Propanol | NA | NV | | na | NA | 9.84E+05 | | na |
| 2-Methylpropanal | NA | NV | | na | NA | NA | | na |
| Methacrolein | NA | NV | | na | NA | NA | | na |
| 2,3-Butanedione | NA | NV | | na | NA | NA | | na |
| Methyl-Vinyl Ketone | NA | NV | | na | NA | 8.61E+01 | | na |
| **MTBE** | 1.22E-08 | 3.10E+03 | 3.93E-12 | no | 8.54E-05 | 4.32E+05 | 1.98E-10 | no |
| Butanal | 8.97E-08 | NV | | na | 6.29E-04 | 7.38E+04 | 8.52E-09 | no |
| 2-Butanone | 1.42E-07 | 1.00E+03 | 1.42E-10 | no | 9.93E-04 | 8.85E+05 | 1.12E-09 | no |
| Tetrahydrofuran | NA | 9.89E-01 | | na | NA | 7.38E+05 | | na |
| 2-Methyl-1-propanol | NA | 1.10E+03 | | na | NA | 4.55E+05 | | na |
| trans-2-Butenal | NA | 3.54E-03 | | na | NA | NA | | na |
| Acetic Acid | 1.52E-07 | NV | | na | 1.07E-03 | 3.68E+04 | 2.90E-08 | no |
| 2-Pentanone | 1.76E-07 | NV | | na | 1.23E-03 | 8.80E+05 | 1.40E-09 | no |
| Pentanal | 1.42E-08 | NV | | na | NA | NA | | na |
| 4-Methyl-2-pentanone | NA | 8.30E+01 | | na | NA | 3.07E+05 | | na |
| trans-2-Pentenal | NA | NV | | na | NA | NA | | na |
| Cyclopentanone | NA | NV | | na | NA | NA | | na |
| 2-Hexanone | 6.60E-08 | 5.11E+00 | 1.29E-08 | no | 4.62E-04 | 4.09E+04 | 1.13E-08 | no |
| Hexanal | NA | NV | | na | NA | NA | | na |
| 3-Furaldehyde | NA | NV | | na | NA | NA | | na |
| Butyl Acetate | NA | NV | | na | NA | NA | | na |
| 2-Furaldehyde | NA | 5.20E+01 | | na | NA | 7.86E+03 | | na |

## Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

| | Red Parachute Signal Flare | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Compound (a)** | **$C_{chronic}$ (µg/m$^3$)** | **Health-Based Screening Level (µg/m$^3$)** | **$C_{chronic}$/ HBSL** | **> 1?** | **$C_{acute}$ (µg/m$^3$)** | **Acute Toxicity Value (µg/m$^3$)** | **$C_{acute}$/ ATV** | **> 1?** |
| trans-2-Hexenal | NA | NV | | na | NA | NA | | na |
| 1-Hexanol | NA | NV | | na | NA | 8.36E+03 | | na |
| 3-Heptanone | 1.52E-07 | NV | | na | NA | NA | | na |
| 2-Heptanone | NA | NV | | na | NA | 1.70E+03 | | na |
| Heptanal | NA | NV | | na | NA | NA | | na |
| trans-2-Heptenal | NA | NV | | na | NA | NA | | na |
| 5-Methyl-2-furaldehyde | NA | NV | | na | NA | NA | | na |
| 6-Methyl-2-heptanone | NA | NV | | na | NA | NA | | na |
| Benzaldehyde | 7.10E-08 | 3.70E+02 | 1.92E-10 | no | 4.97E-04 | 1.50E+04 | 3.32E-08 | no |
| 1-Heptanol | NA | NV | | na | NA | NA | | na |
| 6-Methyl-5-hepten-2-one | NA | NV | | na | NA | NA | | na |
| 2-Octanone | NA | NV | | na | NA | NA | | na |
| Octanal | NA | NV | | na | NA | NA | | na |
| Benzofuran | NA | NV | | na | NA | NA | | na |
| trans-2-Octenal | NA | NV | | na | NA | NA | | na |
| Acetophenone | 2.65E-08 | 2.10E-02 | 1.26E-06 | no | 1.86E-04 | 3.00E+04 | 6.20E-09 | no |
| 2-Nonanone | NA | NV | | na | NA | NA | | na |
| Nonanal | 5.41E-07 | NV | | na | NA | NA | | na |
| trans-2-Nonenal | NA | NV | | na | NA | NA | | na |
| 2-Decanone | NA | NV | | na | NA | NA | | na |
| Decanal | 8.05E-07 | NV | | na | NA | NA | | na |

Footnotes:

(a) Items in bold represent duplicate values for those compounds that are common for Method TO-14 and TO-12.

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

$C_{chronic}$ = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

>1? = Is the ratio greater than one?

## Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

| | Red Parachute Signal Flare | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Compound (a)** | **$C_{chronic}$ (µg/m$^3$)** | **Health-Based Screening Level (µg/m$^3$)** | **$C_{chronic}$/ HBSL** | **> 1?** | **$C_{acute}$ (µg/m$^3$)** | **Acute Toxicity Value (µg/m$^3$)** | **$C_{acute}$/ ATV** | **> 1?** |
| $C_{acute}$ = Acute concentration<br>ATV = Acute toxicity value | | | | | | | | |

## Table D-3: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds

| | Red Parachute Signal Flare | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Compound** | **$C_{chronic}$ ($\mu g/m^3$)** | **Health-Based Screening Level ($\mu g/m^3$)** | **$C_{chronic}$/ HBSL** | **> 1?** | **$C_{acute}$ ($\mu g/m^3$)** | **Acute Toxicity Value ($\mu g/m^3$)** | **$C_{acute}$/ ATV** | **> 1?** |
| **Particulate/Vapor-phase SVOCs** | | | | | | | | |
| N-Nitrosodimethylamine | NA | 1.40E-04 | | na | NA | 2.50E+03 | | na |
| Pyridine | NA | 3.65E+00 | | na | NA | 4.85E+04 | | na |
| 2-Picoline | NA | NV | | na | NA | NA | | na |
| Methyl methanesulfonate | NA | NV | | na | NA | NA | | na |
| N-Nitrosomethylethylamine | NA | 3.06E-04 | | na | NA | NA | | na |
| N-Nitrosodiethylamine | NA | 4.47E-05 | | na | NA | NA | | na |
| Ethyl methanesulfonate | NA | NV | | na | NA | NA | | na |
| Phenol | NA | 2.19E+03 | | na | NA | 3.85E+05 | | na |
| Aniline | NA | 1.06E+00 | | na | NA | 2.29E+04 | | na |
| bis(2-Chloroethyl)ether | NA | 5.80E-03 | | na | NA | 5.85E+04 | | na |
| Pentachloroethane | NA | NV | | na | NA | NA | | na |
| 2-Chlorophenol | NA | 1.80E+01 | | na | NA | 5.25E+03 | | na |
| 1,3-Dichlorobenzene | NA | NV | | na | NA | NA | | na |
| 1,4-Dichlorobenzene | NA | 2.80E-01 | | na | NA | 6.61E+05 | | na |
| Benzyl alcohol | NA | 1.10E+03 | | na | NA | 5.53E+04 | | na |
| 2-Methylphenol | NA | NV | | na | NA | 6.63E+04 | | na |
| 1,2-Dichlorobenzene | NA | 2.09E+02 | | na | NA | 3.01E+05 | | na |
| bis(2-Chloroisopropyl)ether | NA | 1.92E-01 | | na | NA | 6.99E+04 | | na |
| o-Toluidine | NA | 2.80E-02 | | na | NA | 2.63E+04 | | na |
| 4-Methylphenol/3-Methylphenol | NA | NV | | na | NA | 6.63E+04 | | na |
| N-Nitroso-di-n-propylamine | NA | 9.61E-04 | | na | NA | 5.32E+03 | | na |
| Acetophenone | 3.14E-07 | 2.10E-02 | 1.50E-05 | no | 2.20E-03 | 1.47E+05 | 1.50E-08 | no |
| N-Nitrosomorpholine | NA | NV | | na | NA | 3.00E+04 | | na |
| N-Nitrosopyrrolidine | NA | 3.15E-03 | | na | NA | NA | | na |
| Hexachloroethane | NA | 4.80E-01 | | na | NA | 2.90E+04 | | na |
| Nitrobenzene | NA | 2.09E+00 | | na | NA | 1.51E+04 | | na |
| N-Nitrosopiperidine | NA | NV | | na | NA | NA | | na |
| Isophorone | NA | 7.08E+00 | | na | NA | 2.83E+04 | | na |
| 2,4-Dimethylphenol | NA | 7.30E+01 | | na | NA | NA | | na |
| 2-Nitrophenol | NA | NV | | na | NA | NA | | na |

## Table D-3: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds

| | Red Parachute Signal Flare | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Compound | $C_{chronic}$ ($\mu g/m^3$) | Health-Based Screening Level ($\mu g/m^3$) | $C_{chronic}$/ HBSL | > 1? | $C_{acute}$ ($\mu g/m^3$) | Acute Toxicity Value ($\mu g/m^3$) | $C_{acute}$/ ATV | > 1? |
| bis(2-Chloroethoxy)methane | NA | NV | | na | NA | NA | | na |
| Benzoic acid | 3.56E-07 | 1.50E+04 | 2.37E-11 | no | 2.49E-03 | 1.25E+04 | 1.99E-07 | no |
| 2,4-Dichlorophenol | NA | 1.10E+01 | | na | NA | 3.00E+04 | | na |
| 1,2,4-Trichlorobenzene | NA | NV | | na | NA | 3.71E+04 | | na |
| Naphthalene | NA | 3.13E+00 | | na | NA | 7.86E+04 | | na |
| p-Chloroaniline | NA | 1.46E+01 | | na | NA | 5.21E+03 | | na |
| 2,6-Dichlorophenol | NA | NV | | na | NA | 3.00E+04 | | na |
| Hexachloropropene | NA | NV | | na | NA | NA | | na |
| Hexachlorobutadiene | NA | 8.73E-02 | | na | NA | 3.21E+04 | | na |
| Dimethylphenethylamine | NA | NV | | na | NA | NA | | na |
| N-Nitroso-di-n-butylamine | NA | 1.20E-03 | | na | NA | NA | | na |
| 4-Chloro-3-methylphenol | NA | NV | | na | NA | NA | | na |
| Safrole | NA | NV | | na | NA | NA | | na |
| 2-Methylnaphthalene | NA | NV | | na | NA | 2.00E+04 | | na |
| 1,2,4,5-Tetrachlorobenzene | NA | 1.10E+00 | | na | NA | 3.00E+04 | | na |
| Hexachlorocyclopentadiene | NA | 7.30E-02 | | na | NA | 2.23E+02 | | na |
| 2,4,6-Trichlorophenol | NA | 6.20E-01 | | na | NA | 3.00E+04 | | na |
| 2,4,5-Trichlorophenol | NA | 3.70E+02 | | na | NA | 3.00E+04 | | na |
| Isosafrole | NA | NV | | na | NA | NA | | na |
| 2-Chloronaphthalene | NA | 2.90E+02 | | na | NA | 6.00E+02 | | na |
| 2-Nitroaniline | NA | 2.10E-01 | | na | NA | NA | | na |
| 1,4-Naphthoquinone | NA | NV | | na | NA | 2.50E+02 | | na |
| Dimethylphthalate | NA | 3.65E+04 | | na | NA | 1.50E+04 | | na |
| 1,3-Dinitrobenzene | NA | 3.70E-01 | | na | NA | 3.00E+03 | | na |
| 2,6-Dinitrotoluene | NA | 3.70E+00 | | na | NA | 6.00E+02 | | na |
| Acenaphthylene | NA | NV | | na | NA | 2.00E+02 | | na |
| 3-Nitroaniline | NA | NV | | na | NA | NA | | na |
| 4-Nitrophenol | NA | 2.90E+01 | | na | NA | 3.00E+04 | | na |
| 2,4-Dinitrophenol | NA | 7.30E+00 | | na | NA | 7.50E+03 | | na. |
| Acenaphthene | NA | 2.20E+02 | | na | NA | 1.25E+03 | | na |
| 2,4-Dinitrotoluene | NA | 7.30E+00 | | na | NA | 6.00E+02 | | na |

Table D-3: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds

| | Red Parachute Signal Flare | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Compound | $C_{chronic}$ ($\mu g/m^3$) | Health-Based Screening Level ($\mu g/m^3$) | $C_{chronic}$/ HBSL | > 1? | $C_{acute}$ ($\mu g/m^3$) | Acute Toxicity Value ($\mu g/m^3$) | $C_{acute}$/ ATV | > 1? |
| Dibenzofuran | NA | 1.46E+01 | | na | NA | 1.50E+00 | | na |
| Pentachlorobenzene | NA | 2.92E+00 | | na | NA | 3.00E+04 | | na |
| 1-Naphthylamine | NA | NV | | na | NA | 3.50E+04 | | na |
| 2-Naphthylamine | NA | NV | | na | NA | 7.50E+03 | | na |
| 2,3,4,6-Tetrachlorophenol | NA | 1.10E+02 | | na | NA | NA | | na |
| Diethylphthalate | 4.55E-08 | 2.92E+03 | 1.56E-11 | no | 3.19E-04 | 1.50E+04 | 2.13E-08 | no |
| 4-Chlorophenylphenyl ether | NA | NV | | na | NA | NA | | na |
| Fluorene | NA | 1.46E+02 | | na | NA | 7.50E+04 | | na |
| 5-Nitro-o-toluidine | NA | 2.00E-01 | | na | NA | NA | | na |
| 4-Nitroaniline | NA | NV | | na | NA | 9.00E+03 | | na |
| 4,6-Dinitro-2-methylphenol | NA | 3.65E-01 | | na | NA | 5.00E+02 | | na |
| Diphenylamine/N-NitrosoDPA | NA | NV | | na | NA | 2.50E+03 | | na |
| sym-Trinitrobenzene | NA | 1.10E+02 | | na | NA | 3.00E+04 | | na |
| Diallate | NA | 1.10E-01 | | na | NA | NA | | na |
| Phenacetin | NA | NV | | na | NA | 3.00E+04 | | na |
| 4-Bromophenylphenyl ether | NA | NV | | na | NA | NA | | na |
| Hexachlorobenzene | NA | 4.18E-03 | | na | NA | 7.50E+01 | | na |
| 4-Aminobiphenyl | NA | NV | | na | NA | 1.50E+03 | | na |
| Pronamide | NA | 2.74E+02 | | na | NA | NA | | na |
| Pentachlorophenol | NA | 5.60E-02 | | na | NA | 1.50E+03 | | na |
| Pentachloronitrobenzene | NA | 2.59E-02 | | na | NA | 1.50E+03 | | na |
| Phenanthrene | NA | NV | | na | NA | 2.00E+03 | | na |
| Anthracene | NA | 1.10E+03 | | na | NA | 6.00E+03 | | na |
| Carbazole | NA | 3.36E-01 | | na | NA | NA | | na |
| Di-n-butylphthalate | NA | 3.65E+02 | | na | NA | 1.50E+04 | | na |
| 4-Nitroquinoline-1-oxide | NA | NV | | na | NA | NA | | na |
| Methapyrilene | NA | NV | | na | NA | NA | | na |
| Fluoranthene | NA | 1.50E+02 | | na | NA | 3.00E+01 | | na |
| Benzidine | NA | 2.90E-05 | | na | NA | 5.00E+02 | | na |
| Pyrene | NA | NV | | na | NA | 1.50E+04 | | na |
| p-Dimethylaminoazobenzene | NA | NV | | na | NA | 7.50E+04 | | na |

## Table D-3: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds

| Compound | Red Parachute Signal Flare | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | $C_{chronic}$ ($\mu g/m^3$) | Health-Based Screening Level ($\mu g/m^3$) | $C_{chronic}$/ HBSL | > 1? | $C_{acute}$ ($\mu g/m^3$) | Acute Toxicity Value ($\mu g/m^3$) | $C_{acute}$/ ATV | > 1? |
| Chlorobenzilate | NA | 2.49E-02 | | na | NA | 2.50E+02 | | na |
| Kepone | NA | 3.74E-04 | | na | NA | 1.00E+02 | | na |
| Butylbenzylphthalate | 1.12E-07 | 7.30E+02 | 1.53E-10 | no | 7.83E-04 | 5.00E+05 | 1.57E-09 | no |
| 3,3'-Dimethylbenzidine | NA | 7.30E-04 | | na | NA | 3.00E+00 | | na |
| 2-Acetylaminofluorene | NA | NV | | na | NA | 2.50E+03 | | na |
| bis(2-Ethylhexyl)phthalate | 3.10E-08 | 4.80E-01 | 6.45E-08 | no | 5.07E-04 | 1.00E+04 | 5.07E-08 | no |
| 3,3'-Dichlorobenzidine | NA | 1.50E-02 | | na | NA | 6.21E+03 | | na |
| Benz(a)anthracene | NA | 2.20E-02 | | na | NA | 6.00E+02 | | na |
| Chrysene | NA | 2.17E+00 | | na | NA | 2.00E+02 | | na |
| Di-n-octylphthalate | 6.68E-08 | 7.30E+01 | 9.15E-10 | no | 4.68E-04 | 1.50E+05 | 3.12E-09 | no |
| 7,12-Dimethylbenz(a)anthracene | NA | NV | | na | NA | NA | | na |
| Benzo(b)fluoranthene | NA | 2.20E-02 | | na | NA | NA | | na |
| Benzo(k)fluoranthene | NA | 2.20E-01 | | na | NA | NA | | na |
| Benz(a)pyrene | NA | 2.20E-03 | | na | NA | 7.50E+03 | | na |
| 3-Methylcholanthrene | NA | NV | | na | NA | 1.50E+03 | | na |
| Indeno(1,2,3-cd)pyrene | NA | 2.17E-02 | | na | NA | NA | | na |
| Dibenz(a,h)anthracene | NA | 2.17E-03 | | na | NA | 3.00E+04 | | na |
| Benzo(g,h,i)perylene | NA | NV | | na | NA | 3.00E+04 | | na |

Footnotes:

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

$C_{chronic}$ = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

>1? = Is the ratio greater than one?

$C_{acute}$ = Acute concentration

ATV = Acute toxicity value

## Table D-4: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons

| | Red Parachute Signal Flare | | | |
|---|---|---|---|---|
| Compound (a) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) |
| | *Aliphatic:C<=8* | *Aliphatic:C>8* | *Aromatic:C<=8* | *Aromatic:C>8* |
| TNMHC | NA | NA | NA | NA |
| Ethane | NA | NA | NA | NA |
| Ethylene | NA | NA | NA | NA |
| Acetylene | NA | NA | NA | NA |
| Propane | 3.78E-07 | NA | NA | NA |
| Propene | 3.86E-06 | NA | NA | NA |
| i-Butane | 7.56E-08 | NA | NA | NA |
| i-Butene | 2.12E-07 | NA | NA | NA |
| 1-Butene | 7.56E-07 | NA | NA | NA |
| 1,3-Butadiene | NA | NA | NA | NA |
| n-Butane | 1.06E-07 | NA | NA | NA |
| trans-2-Butene | 7.56E-07 | NA | NA | NA |
| 2,2-Dimethylpropane | NA | NA | NA | NA |
| cis-2-Butene | 1.36E-07 | NA | NA | NA |
| 3-Methyl-1-butene | NA | NA | NA | NA |
| i-Pentane | NA | NA | NA | NA |
| 1-Pentene | 1.51E-07 | NA | NA | NA |
| 2-Methyl-1-butene | 3.02E-08 | NA | NA | NA |
| n-Pentane | 1.81E-07 | NA | NA | NA |
| Isoprene | NA | NA | NA | NA |
| trans-2-Pentene | 3.02E-08 | NA | NA | NA |
| cis-2-Pentene | 3.02E-08 | NA | NA | NA |
| 2-Methyl-2-butene | 6.05E-08 | NA | NA | NA |
| 2,2-Dimethylbutane | 6.05E-08 | NA | NA | NA |
| Cyclopentene | 4.54E-08 | NA | NA | NA |

## Table D-4: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons

| | Red Parachute Signal Flare | | | |
|---|---|---|---|---|
| Compound (a) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) |
| | ***Aliphatic:C<=8*** | ***Aliphatic:C>8*** | ***Aromatic:C<=8*** | ***Aromatic:C>8*** |
| 4-Methyl-1-pentene | NA | NA | NA | NA |
| Cyclopentane | 1.51E-08 | NA | NA | NA |
| 2,3-Dimethylbutane | 1.51E-08 | NA | NA | NA |
| cis-4-Methyl-2-pentene | NA | NA | NA | NA |
| 2-Methylpentane | 3.02E-08 | NA | NA | NA |
| 3-Methylpentane | NA | NA | NA | NA |
| 2-Methyl-1-pentene | NA | NA | NA | NA |
| 1-Hexene | 1.21E-07 | NA | NA | NA |
| n-Hexane | 3.02E-08 | NA | NA | NA |
| trans-2-Hexene | NA | NA | NA | NA |
| 2-Methyl-2-pentene | NA | NA | NA | NA |
| cis-2-Hexene | NA | NA | NA | NA |
| Methylcyclopentane | 4.54E-08 | NA | NA | NA |
| 2,4-Dimethylpentane | NA | NA | NA | NA |
| **Benzene** | NA | NA | 1.75E-06 | NA |
| Cyclohexane | 1.21E-07 | NA | NA | NA |
| 2-Methylhexane | NA | NA | NA | NA |
| 2,3-Dimethylpentane | NA | NA | NA | NA |
| 3-Methylhexane | NA | NA | NA | NA |
| 2,2,4-Trimethylpentane | NA | NA | NA | NA |
| n-Heptane | 7.56E-08 | NA | NA | NA |
| 2,4,4-Trimethyl-1-pentene | NA | NA | NA | NA |
| Methylcyclohexane | NA | NA | NA | NA |
| 2,4,4-Trimethyl-2-pentene | NA | NA | NA | NA |
| 2,5-Dimethylhexane | 1.51E-08 | NA | NA | NA |

## Table D-4: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons

| | Red Parachute Signal Flare | | | |
|---|---|---|---|---|
| Compound (a) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) |
| | *Aliphatic:C<=8* | *Aliphatic:C>8* | *Aromatic:C<=8* | *Aromatic:C>8* |
| 2,4-Dimethylhexane | NA | NA | NA | NA |
| 2,3,4-Trimethylpentane | 1.64E-23 | NA | NA | NA |
| **Toluene** | NA | NA | 3.63E-07 | NA |
| 2,3-Dimethylhexane | NA | NA | NA | NA |
| 2-Methylheptane | 3.02E-08 | NA | NA | NA |
| 3-Ethylhexane | 3.02E-08 | NA | NA | NA |
| 2,2-Dimethylheptane | NA | NA | NA | NA |
| 2,2,4-Trimethylhexane | NA | NA | NA | NA |
| n-Octane | 3.02E-08 | NA | NA | NA |
| Ethylcyclohexane | NA | NA | NA | NA |
| **Ethylbenzene** | NA | NA | NA | NA |
| **m-Xylene & p-Xylene** | NA | NA | NA | NA |
| **Styrene** | NA | NA | NA | 1.36E-07 |
| **o-Xylene** | NA | NA | NA | NA |
| n-Nonane | NA | 2.27E-07 | NA | NA |
| i-Propylbenzene | NA | NA | NA | NA |
| n-Propylbenzene | NA | NA | NA | 6.05E-08 |
| **p-Ethyltoluene** | NA | NA | NA | 1.51E-07 |
| m-Ethyltoluene | NA | NA | NA | 9.07E-08 |
| **1,3,5-Trimethylbenzene** | NA | NA | NA | 7.56E-08 |
| o-Ethyltoluene | NA | NA | NA | 1.21E-07 |
| **1,2,4-Trimethylbenzene & sec-Butylbenzene** | NA | NA | NA | 1.81E-07 |
| n-Decane | NA | NA | NA | NA |
| alpha-Pinene | NA | NA | NA | NA |
| beta-Pinene | NA | NA | NA | NA |

## Table D-4: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons

| | Red Parachute Signal Flare | | | |
|---|---|---|---|---|
| Compound (a) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) |
| | ***Aliphatic:C<=8*** | ***Aliphatic:C>8*** | ***Aromatic:C<=8*** | ***Aromatic:C>8*** |
| delta 3-Carene | NA | NA | NA | NA |
| d-Limonene | NA | NA | NA | NA |
| MTBE | NA | NA | NA | NA |
| Dichlorodifluoromethane | NA | NA | NA | NA |
| Methylchloride | NA | NA | NA | NA |
| Dichlorotetrafluoroethane | NA | NA | NA | NA |
| Chloroethene | NA | NA | NA | NA |
| 1,3-Butadiene | NA | NA | NA | NA |
| Methylbromide | NA | NA | NA | NA |
| Ethylchloride | NA | NA | NA | NA |
| Trichloromonofluoromethane | NA | NA | NA | NA |
| Vinylidenechloride | NA | NA | NA | NA |
| Methylenechloride | NA | NA | NA | NA |
| Allylchloride | NA | NA | NA | NA |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | NA | NA | NA | NA |
| 1,1-Dichloroethane | NA | NA | NA | NA |
| 1,2-Dichloroethene | NA | NA | NA | NA |
| Chloroform | NA | NA | NA | NA |
| 1,2-Dichloroethane | NA | NA | NA | NA |
| Methylchloroform | NA | NA | NA | NA |
| **Benzene** | NA | NA | 1.78E-06 | NA |
| Carbontetrachloride | NA | NA | NA | NA |
| 1,2-Dichloropropane | NA | NA | NA | NA |
| Trichloroethylene | NA | NA | NA | NA |
| cis 1,3-Dichloro-1-propene | NA | NA | NA | NA |

## Table D-4: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons

| | Red Parachute Signal Flare | | | |
|---|---|---|---|---|
| Compound (a) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) |
| | *Aliphatic:C<=8* | *Aliphatic:C>8* | *Aromatic:C<=8* | *Aromatic:C>8* |
| trans 1,3-Dichloro-1-propene | NA | NA | NA | NA |
| 1,1,2-Trichloroethane | NA | NA | NA | NA |
| **Toluene** | NA | NA | 3.69E-07 | NA |
| 1,2-Dibromoethane | NA | NA | NA | NA |
| Perchloroethylene | NA | NA | NA | NA |
| Chlorobenzene | NA | NA | NA | NA |
| **Ethylbenzene** | NA | NA | NA | NA |
| **m&p-Xylene** | NA | NA | NA | NA |
| **Styrene** | NA | NA | NA | 1.38E-07 |
| 1,1,2,2-Tetrachloroethane | NA | NA | NA | NA |
| **o-Xylene** | NA | NA | NA | NA |
| **p-Ethyltoluene** | NA | NA | NA | 1.54E-07 |
| **1,3,5-Trimethylbenzene** | NA | NA | NA | 9.23E-08 |
| **1,2,4-Trimethylbenzene** | NA | NA | NA | 1.85E-07 |
| Benzylchloride | NA | NA | NA | NA |
| m-Dichlorobenzene | NA | NA | NA | NA |
| p-Dichlorobenzene | NA | NA | NA | NA |
| o-Dichlorobenzene | NA | NA | NA | NA |
| 1,2,4-Trichlorobenzene | NA | NA | NA | NA |
| Hexachlorobutadiene | NA | NA | NA | NA |
| trans-1,2-Dichloroethene | NA | NA | NA | NA |
| o-Chlorotoluene | NA | NA | NA | NA |
| p-Chlorotoluene | NA | NA | NA | NA |
| 1,3,5-Trichlorobenzene | NA | NA | NA | NA |
| 1,2,3-Trichlorobenzene | NA | NA | NA | NA |

## Table D-4: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons

| | Red Parachute Signal Flare | | | |
|---|---|---|---|---|
| Compound (a) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) |
| | *Aliphatic:C<=8* | *Aliphatic:C>8* | *Aromatic:C<=8* | *Aromatic:C>8* |
| Methylnitrite | NA | NA | NA | NA |
| Acetonitrile | NA | NA | NA | NA |
| Acrylonitrile | NA | NA | NA | NA |
| Nitromethane | NA | NA | NA | NA |
| Benzonitrile | NA | NA | NA | NA |
| Nitrobenzene | NA | NA | NA | NA |
| Carbonyl Sulfide | NA | NA | NA | NA |
| Sulfur Dioxide | NA | NA | NA | NA |
| Carbon Disulfide | NA | NA | NA | NA |
| Thiophene | NA | NA | NA | NA |
| Dimethyldisulfide | NA | NA | NA | NA |
| 2-Methylthiophene | NA | NA | NA | NA |
| 3-Methylthiophene | NA | NA | NA | NA |
| Dimethyltrisulfide | NA | NA | NA | NA |
| Isothiocyanatomethane | NA | NA | NA | NA |
| 2-Chlorothiophene | NA | NA | NA | NA |
| 3-Chlorothiophene | NA | NA | NA | NA |
| 2-Thiophenecarboxaldehyde | NA | NA | NA | NA |
| **Naphthalene** | NA | NA | NA | 9.90E-08 |
| Acetaldehyde | NA | NA | NA | NA |
| Acrolein | NA | NA | NA | NA |
| Acetone | NA | NA | NA | NA |
| Propanal | NA | NA | NA | NA |
| Furan | NA | NA | NA | NA |
| 2-Propanol | NA | NA | NA | NA |

## Table D-4: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons

| | Red Parachute Signal Flare | | | |
|---|---|---|---|---|
| Compound (a) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) |
| | *Aliphatic:C<=8* | *Aliphatic:C>8* | *Aromatic:C<=8* | *Aromatic:C>8* |
| 2-Methylpropanal | NA | NA | NA | NA |
| Methacrolein | NA | NA | NA | NA |
| 2,3-Butanedione | NA | NA | NA | NA |
| Methyl-Vinyl Ketone | NA | NA | NA | NA |
| MTBE | NA | NA | NA | NA |
| Butanal | NA | NA | NA | NA |
| 2-Butanone | NA | NA | NA | NA |
| Tetrahydrofuran | NA | NA | NA | NA |
| 2-Methyl-1-propanol | NA | NA | NA | NA |
| trans-2-Butenal | NA | NA | NA | NA |
| Acetic Acid | NA | NA | NA | NA |
| 2-Pentanone | NA | NA | NA | NA |
| Pentanal | NA | NA | NA | NA |
| 4-Methyl-2-pentanone | NA | NA | NA | NA |
| trans-2-Pentenal | NA | NA | NA | NA |
| Cyclopentanone | NA | NA | NA | NA |
| 2-Hexanone | NA | NA | NA | NA |
| Hexanal | NA | NA | NA | NA |
| 3-Furaldehyde | NA | NA | NA | NA |
| Butyl Acetate | NA | NA | NA | NA |
| 2-Furaldehyde | NA | NA | NA | NA |
| trans-2-Hexenal | NA | NA | NA | NA |
| 1-Hexanol | NA | NA | NA | NA |
| 3-Heptanone | NA | NA | NA | NA |
| 2-Heptanone | NA | NA | NA | NA |

## Table D-4: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons

| | Red Parachute Signal Flare | | | |
|---|---|---|---|---|
| Compound (a) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) |
| | *Aliphatic:C<=8* | *Aliphatic:C>8* | *Aromatic:C<=8* | *Aromatic:C>8* |
| Heptanal | NA | NA | NA | NA |
| trans-2-Heptenal | NA | NA | NA | NA |
| 5-Methyl-2-furaldehyde | NA | NA | NA | NA |
| 6-Methyl-2-heptanone | NA | NA | NA | NA |
| Benzaldehyde | NA | NA | NA | NA |
| 1-Heptanol | NA | NA | NA | NA |
| 6-Methyl-5-hepten-2-one | NA | NA | NA | NA |
| 2-Octanone | NA | NA | NA | NA |
| Octanal | NA | NA | NA | NA |
| Benzofuran | NA | NA | NA | NA |
| trans-2-Octenal | NA | NA | NA | NA |
| Acetophenone | NA | NA | NA | NA |
| 2-Nonanone | NA | NA | NA | NA |
| Nonanal | NA | NA | NA | NA |
| trans-2-Nonenal | NA | NA | NA | NA |
| 2-Decanone | NA | NA | NA | NA |
| Decanal | NA | NA | NA | NA |
| N-Nitrosodimethylamine | NA | NA | NA | NA |
| Pyridine | NA | NA | NA | NA |
| 2-Picoline | NA | NA | NA | NA |
| Methyl methanesulfonate | NA | NA | NA | NA |
| N-Nitrosomethylethylamine | NA | NA | NA | NA |
| N-Nitrosodiethylamine | NA | NA | NA | NA |
| Ethyl methanesulfonate | NA | NA | NA | NA |
| Phenol | NA | NA | NA | NA |

## Table D-4: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons

| | Red Parachute Signal Flare | | | |
|---|---|---|---|---|
| Compound (a) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) |
| | *Aliphatic:C<=8* | *Aliphatic:C>8* | *Aromatic:C<=8* | *Aromatic:C>8* |
| Aniline | NA | NA | NA | NA |
| bis(2-Chloroethyl)ether | NA | NA | NA | NA |
| Pentachloroethane | NA | NA | NA | NA |
| 2-Chlorophenol | NA | NA | NA | NA |
| 1,3-Dichlorobenzene | NA | NA | NA | NA |
| 1,4-Dichlorobenzene | NA | NA | NA | NA |
| Benzyl alcohol | NA | NA | NA | NA |
| 2-Methylphenol | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | NA | NA | NA | NA |
| bis(2-Chloroisopropyl)ether | NA | NA | NA | NA |
| o-Toluidine | NA | NA | NA | NA |
| 4-Methylphenol/3-Methylphenol | NA | NA | NA | NA |
| N-Nitroso-di-n-propylamine | NA | NA | NA | NA |
| Acetophenone | NA | NA | NA | NA |
| N-Nitrosomorpholine | NA | NA | NA | NA |
| N-Nitrosopyrrolidine | NA | NA | NA | NA |
| Hexachloroethane | NA | NA | NA | NA |
| Nitrobenzene | NA | NA | NA | NA |
| N-Nitrosopiperidine | NA | NA | NA | NA |
| Isophorone | NA | NA | NA | NA |
| 2,4-Dimethylphenol | NA | NA | NA | NA |
| 2-Nitrophenol | NA | NA | NA | NA |
| bis(2-Chloroethoxy)methane | NA | NA | NA | NA |
| Benzoic acid | NA | NA | NA | NA |
| 2,4-Dichlorophenol | NA | NA | NA | NA |

## Table D-4: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons

| | Red Parachute Signal Flare | | | |
|---|---|---|---|---|
| Compound (a) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) |
| | *Aliphatic:C<=8* | *Aliphatic:C>8* | *Aromatic:C<=8* | *Aromatic:C>8* |
| 1,2,4-Trichlorobenzene | NA | NA | NA | NA |
| **Naphthalene** | NA | NA | NA | NA |
| p-Chloroaniline | NA | NA | NA | NA |
| 2,6-Dichlorophenol | NA | NA | NA | NA |
| Hexachloropropene | NA | NA | NA | NA |
| Hexachlorobutadiene | NA | NA | NA | NA |
| Dimethylphenethylamine | NA | NA | NA | NA |
| N-Nitroso-di-n-butylamine | NA | NA | NA | NA |
| 4-Chloro-3-methylphenol | NA | NA | NA | NA |
| Safrole | NA | NA | NA | NA |
| 2-Methylnaphthalene | NA | NA | NA | NA |
| 1,2,4,5-Tetrachlorobenzene | NA | NA | NA | NA |
| Hexachlorocyclopentadiene | NA | NA | NA | NA |
| 2,4,6-Trichlorophenol | NA | NA | NA | NA |
| 2,4,5-Trichlorophenol | NA | NA | NA | NA |
| Isosafrole | NA | NA | NA | NA |
| 2-Chloronaphthalene | NA | NA | NA | NA |
| 2-Nitroaniline | NA | NA | NA | NA |
| 1,4-Naphthoquinone | NA | NA | NA | NA |
| Dimethylphthalate | NA | NA | NA | NA |
| 1,3-Dinitrobenzene | NA | NA | NA | NA |
| 2,6-Dinitrotoluene | NA | NA | NA | NA |
| Acenaphthylene | NA | NA | NA | NA |
| 3-Nitroaniline | NA | NA | NA | NA |
| 4-Nitrophenol | NA | NA | NA | NA |

## Table D-4: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons

| | Red Parachute Signal Flare | | | |
|---|---|---|---|---|
| Compound (a) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) |
| | *Aliphatic:C<=8* | *Aliphatic:C>8* | *Aromatic:C<=8* | *Aromatic:C>8* |
| 2,4-Dinitrophenol | NA | NA | NA | NA |
| Acenaphthene | NA | NA | NA | NA |
| 2,4-Dinitrotoluene | NA | NA | NA | NA |
| Dibenzofuran | NA | NA | NA | NA |
| Pentachlorobenzene | NA | NA | NA | NA |
| 1-Naphthylamine | NA | NA | NA | NA |
| 2-Naphthylamine | NA | NA | NA | NA |
| 2,3,4,6-Tetrachlorophenol | NA | NA | NA | NA |
| Diethylphthalate | NA | NA | NA | NA |
| 4-Chlorophenylphenyl ether | NA | NA | NA | NA |
| Fluorene | NA | NA | NA | NA |
| 5-Nitro-o-toluidine | NA | NA | NA | NA |
| 4-Nitroaniline | NA | NA | NA | NA |
| 4,6-Dinitro-2-methylphenol | NA | NA | NA | NA |
| Diphenylamine/N-NitrosoDPA | NA | NA | NA | NA |
| sym-Trinitrobenzene | NA | NA | NA | NA |
| Diallate | NA | NA | NA | NA |
| Phenacetin | NA | NA | NA | NA |
| 4-Bromophenylphenyl ether | NA | NA | NA | NA |
| Hexachlorobenzene | NA | NA | NA | NA |
| 4-Aminobiphenyl | NA | NA | NA | NA |
| Pronamide | NA | NA | NA | NA |
| Pentachlorophenol | NA | NA | NA | NA |
| Pentachloronitrobenzene | NA | NA | NA | NA |
| Phenanthrene | NA | NA | NA | NA |

## Table D-4: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons

| | Red Parachute Signal Flare | | | |
|---|---|---|---|---|
| Compound (a) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) |
| | *Aliphatic:C<=8* | *Aliphatic:C>8* | *Aromatic:C<=8* | *Aromatic:C>8* |
| Anthracene | NA | NA | NA | NA |
| Carbazole | NA | NA | NA | NA |
| Di-n-butylphthalate | NA | NA | NA | NA |
| 4-Nitroquinoline-1-oxide | NA | NA | NA | NA |
| Methapyrilene | NA | NA | NA | NA |
| Fluoranthene | NA | NA | NA | NA |
| Benzidine | NA | NA | NA | NA |
| Pyrene | NA | NA | NA | NA |
| p-Dimethylaminoazobenzene | NA | NA | NA | NA |
| Chlorobenzilate | NA | NA | NA | NA |
| Kepone | NA | NA | NA | NA |
| Butylbenzylphthalate | NA | NA | NA | NA |
| 3,3'-Dimethylbenzidine | NA | NA | NA | NA |
| 2-Acetylaminofluorene | NA | NA | NA | NA |
| bis(2-Ethylhexyl)phthalate | NA | NA | NA | NA |
| 3,3'-Dichlorobenzidine | NA | NA | NA | NA |
| Benz(a)anthracene | NA | NA | NA | NA |
| Chrysene | NA | NA | NA | NA |
| Di-n-octylphthalate | NA | NA | NA | NA |
| 7,12-Dimethylbenz(a)anthracene | NA | NA | NA | NA |
| Benzo(b)fluoranthene | NA | NA | NA | NA |
| Benzo(k)fluoranthene | NA | NA | NA | NA |
| Benz(a)pyrene | NA | NA | NA | NA |
| 3-Methylcholanthrene | NA | NA | NA | NA |
| Indeno(1,2,3-cd)pyrene | NA | NA | NA | NA |

## Table D-4: Comparison of Air Concentrations With Health-Based Values: Total Petroleum Hydrocarbons

| | Red Parachute Signal Flare | | | |
|---|---|---|---|---|
| Compound (a) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) | $C_{chronic}$ (µg/m$^3$) |
| | ***Aliphatic:C<=8*** | ***Aliphatic:C>8*** | ***Aromatic:C<=8*** | ***Aromatic:C>8*** |
| Dibenz(a,h)anthracene | NA | NA | NA | NA |
| Benzo(g,h,i)perylene | NA | NA | NA | NA |
| Total (µg/m$^3$) | 7.43E-06 | 2.27E-07 | 2.15E-06 | 7.87E-07 |
| Derived Health-Based Screening Level | 1.92E+04 | 1.04E+03 | 4.17E+02 | 2.09E+02 |
| $C_{chronic}$/HBSL | 3.87E-10 | 2.18E-10 | 5.16E-09 | 3.77E-09 |
| >1? | no | no | no | no |

Footnotes:
(a) Items in bold represent duplicate values: highest concentration was used to estimate total petroleum hydrocarbon concentration
>1? = Is the ratio greater than one?
NA = Not Applicable because compound was not detected
$C_{chronic}$ = chronic averaged air Concentration
HBSL = Health-Based Screening Level

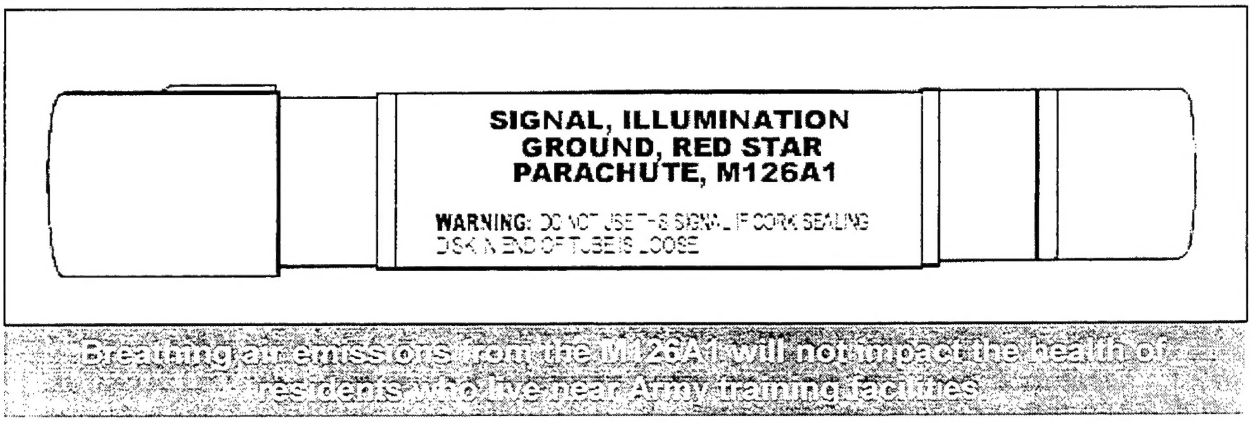
# APPENDIX E

# FACT SHEET SUBMITTED TO AEC

# United States Army Environmental Center
# Pyrotechnics Fact Sheet

## *M126A1 Red Star Parachute Signal Flare*

*Department of Defense Identification Code: L311*




Breathing air emissions from the M126A1 will not impact the health of residents who live near Army training facilities.

### WHAT ARE PYROTECHNICS?

The terms pyrotechnics and fireworks are often used interchangeably. Pyrotechnics are devices that give off smoke, light, and/or a loud noise when activated. Military pyrotechnics are used for signaling, obscuring, and illuminating during training and combat.

### WHAT IS THE M126A1?

The M126A1 is a star parachute signal flare, which is a type of pyrotechnic device used for signaling and illuminating. The M126A1 produces a single, red, parachute-suspended illuminating star. It is 10.16 inches long, 1.67 inches wide, and weighs 1.20 pounds.

### HOW IS THE M126A1 USED?

A rocket containing the signal is launched from a hand-held device. After igniting, the rocket reaches a height of about 200 feet and produces a single, red star illumination resembling a firework. The signal extends to a height of 700 to 750 feet and can be seen from a distance of 30 to 35 miles at night. Use of this device is important in training our troops to use and identify different signals, which is an important method of communication in the field.

### WHERE IS THE M126A1 USED?

The M126A1 is used during many Army training events. These events are held at nearly every Army training installation. At most locations, the training areas are at least 1000 meters (over half a mile) away from populated areas. In general, one item is used during a day of training, which typically occurs five times per year.

### WHAT IS IN THE M126A1?

The M126A1 consists of a parachute-suspended illumination assembly and a rocket motor propulsion assembly. These

are contained in a hand-held aluminum launching tube. The illumination component consists primarily of strontium nitrate, and magnesium powder.

## WILL BREATHING AIR EMISSIONS FROM THE M126A1 AFFECT MY HEALTH?

To answer this question, the U.S. Army Environmental Center tested the air emissions from the M126A1. The U.S. Army Center for Health Promotion and Preventive Medicine then determined if there would be a potential for health effects from inhalation to residents living near training areas. Results showed that residents breathing air as close as 100 meters (328 feet) from the activation site are safe from these emissions.

## HOW WAS THE STUDY DONE?

To gather data for the study, airborne emissions were collected by activating the M126A1 in a test chamber. The air in the chamber was tested to identify the types and amount of substances released. More than 300 substances were looked for during this part of the study.

This information was then used in an air model (a computer program that allows estimation of air concentrations) to determine the amount of each substance, to which someone living near a training area might be exposed. Downwind concentrations were estimated based on a typical use scenario for the M126A1. Since the study does not look at a specific training area, the assumptions used in the model will in most cases, predict higher downwind air concentrations than those expected at an actual training site.

These estimated air concentrations were then compared to safe screening levels established by the U.S. Environmental Protection Agency and other agencies. If the air concentrations are below these screening levels, they are considered safe for everyone, including sensitive people such as the sick, elderly, and children.

## WHAT ARE THE LIMITATIONS OF THIS STUDY?

Many steps were taken to ensure that the results of this study are protective of everyone who lives close to training areas. However, limitations do exist with this study. For example, the study does not consider exposure to other types of munitions that could also be used during the same training event. Due to these limitations, conservative model conditions were used to ensure the protection of public health from inhalation of the M126A1 air emissions.

## WHERE CAN I GET MORE INFORMATION?

For more information on the M126A1 and other military munitions call the Army Environmental Center Hotline at 1-800-USA-3845, visit our website at www.aec.army.mil, or email us at t2hotline@aec.apgea.army.mil.